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WHC-EP-0440
Volume 2

Facility Effluent Monitoring Plan Determinations for the 200 Area Facilities

Prepared for the U.S. Department of Energy
Assistant Secretary for Environment,
Safety and Health

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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Printed in the United States of America

DISCLM-1.CHP (1-91)

WHC-EP-0440
Volume 2

UC-630

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Environmental Assurance

Date Published
November 1991

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Approved for Public Release

U.S. GPO* 1991 691-926

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FACILITY EFFLUENT MONITORING PLAN DETERMINATION FOR THE 200 AREA FACILITIES

ABSTRACT

The following facility effluent monitoring plan determinations document the evaluations conducted for the Westinghouse Hanford Company 200 Area facilities (chemical processing, waste management, 222-S Laboratory, and laundry) on the Hanford Site in south central Washington State. These evaluations determined the need for facility effluent monitoring plans for the 200 Area facilities. The facility effluent monitoring plan determinations have been prepared in accordance with A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, *WHC-EP-0438 (WHC 1991).*

The Plutonium/Uranium Extraction Plant and UO_3 facility effluent monitoring plan determinations were prepared by Los Alamos Technical Associates, Richland, Washington. The Plutonium Finishing Plant, Transuranic Waste Storage and Assay Facility, T Plant, Tank Farms, Low Level Burial Grounds, and 222-S Laboratory determinations were prepared by Science Applications International Corporation of Richland, Washington. The B Plant Facility Effluent Monitoring Plan Determination was prepared by ERCE Environmental Services of Richland, Washington.

Forty-three Westinghouse 200 Area facilities were evaluated. Facility effluent monitoring plans need to be prepared for 15 facilities. The following list summarizes the result of the facility effluent monitoring plan determinations.

Facility	*FEMP Required*
B Plant	*yes*
PUREX	*yes*
UO_3	*yes*
U Plant	*no*
PFP	*yes*
T Plant	*no*
222-S Laboratory	*yes*
233-S	*no*
Laundry	*yes*
GROUT facilities	*no*
244-T TRUSAF	*no*
Central Waste Complex	*no*
Low Level Burial Grounds	*no*
E/W Tank Farms	
241-A	*yes*
241-AX	*no*
241-B	*no*
241-BX	*no*
241-BY	*no*
241-C	*yes*
241-S	*no*
241-SX	*yes*
241-U	*no*
241-TX	*no*
241-TY	*no*
241-U	*no*
241-AN	*no*
241-AP	*yes*
241-AW	*yes*
241-SY	*yes*
244-A	*no*
244-TX	*no*
244-U	*no*
244-S	*no*
244-BX	*no*
241-AY	*yes*
241-AZ	*yes*

Vaults	*FEMP Required*
204-AR	*no*
244-AR	*no*
244-CR	*no*
Evaporators	
242-A	*yes*
242-S	*no*
242-T	*no*

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PART 11

TRANSURANIC WASTE STORAGE AND ASSAY FACILITY

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

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LIST OF TERMS

CAM	continuous air monitor
CFR	Code of Federal Regulations
CIS	Contents Inventory Sheet
CY	calendar year
DF	decontamination factor
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EDE	effective dose equivalent
EPA	U.S. Environmental Protection Agency
FEMP	facility effluent monitoring plan
HEPA	high-efficiency particulate air
HPT	health physics technician
HVAC	heating, ventilation, and air conditioning
MDL	maximum detectable limit
NBS	National Bureau of Standards
ND	not detected
NIST	National Institute of Standards Technology
PEL	permissible exposure limit
RQ	reportable quantity
RTR	real-time radiography
TRU	transuranic
TRUSAF	Transuranic Waste Storage and Assay Facility
TWA	Transuranic Waste Assayer
WAC	Washington Administrative Code
wg	water gauge
Westinghouse Hanford	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Plant

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TRANSURANIC WASTE STORAGE AND ASSAY FACILITY

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

1.0 INTRODUCTION

This document provides information to determine if a facility effluent monitoring plan (FEMP) is required for the Transuranic Waste Storage and Assay Facility (TRUSAF) and ancillary systems. This document has been prepared in accordance with *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* (Guide) (WHC 1991a).

Information concerning the sealed portion of the TRUSAF building and its potential effect on facility effluents was not available. Additional investigations concerning the effects of the sealed portion of the building on facility effluents are provided in Section 4.0.

The scope of this document includes the documentation for monitoring and characterizing radioactive and nonradioactive hazardous materials discharged within the TRUSAF effluents. This report includes complete documentation for installed effluent monitoring systems for hazardous pollutants that could be discharged under routine and/or upset conditions.

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2.0 FACILITY DESCRIPTION

The TRUSAF is located in the 200 West Area of the Hanford Site, which is located in south central Washington State. The only building, structure, or special facility included as part of this FEMP determination is the TRUSAF building (224-T). Systems ancillary to this building are also included. These ancillary systems are the heating, ventilation, and air conditioning (HVAC) system exhaust stacks 286-T-11 and 286-T-12.

Originally, the 224-T Building's function was to purify plutonium nitrate by the lanthanum fluoride process. The plant remained inactive following phase-out of the bismuth phosphate plants until the early 1970s. At that time, the building was modified for storage of plutonium scrap in liquid and solid forms.

In 1984, the 224-T Building was targeted to house the transuranic waste storage and assay operation. The TRUSAF operation consists of a non-destructive analysis of transuranic (TRU) waste. The analysis is used as an overview for sealed, certified, contact-handled, TRU solid-waste packages to verify general compliance with the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria. Those containers meeting WIPP waste acceptance criteria are stored at 224-T and maintained in a manner to retain their certification pending shipment to the WIPP. The TRUSAF operation also performs a sorting function for the plutonium finishing plant. Some containers that are determined by assay to be low-level waste (<100 nCi/g) are transferred to the low-level waste burial trenches. The containers that have deficiencies are returned to those who generated the waste for the correction of the deficiencies or stored in the 200 West Area for future certification processing.

In 1985, the removal of plutonium scrap from 224-T was completed, and the building was officially designated as the TRUSAF.

2.1 PHYSICAL DESCRIPTION

The 224-T Building is approximately 197 ft long and 60 ft wide. A floor plan of the three gallery levels is shown in Figure 1 and a typical cross-section view is shown in Figure 2. The modified building is constructed with reinforced concrete walls, floor, and ceiling.

The three floors of the building used for TRUSAF (See Figure 2) are completely sealed from the southeast third of the building, which contains the six contaminated process cells (A through F). These three floors, which used to comprise the operating gallery and service areas, have been stripped of all unnecessary control equipment, panel boards, and partitions to provide approximately 11,500 ft^2 of storage space. The floors are connected by stairway A at the north end of the building, by stairway B at the south end of the building, and by an elevator adjacent to stairway A. There is also an unloading platform off the elevator on the outside of the building.

Figure 1. Floor Plan of 224-T.

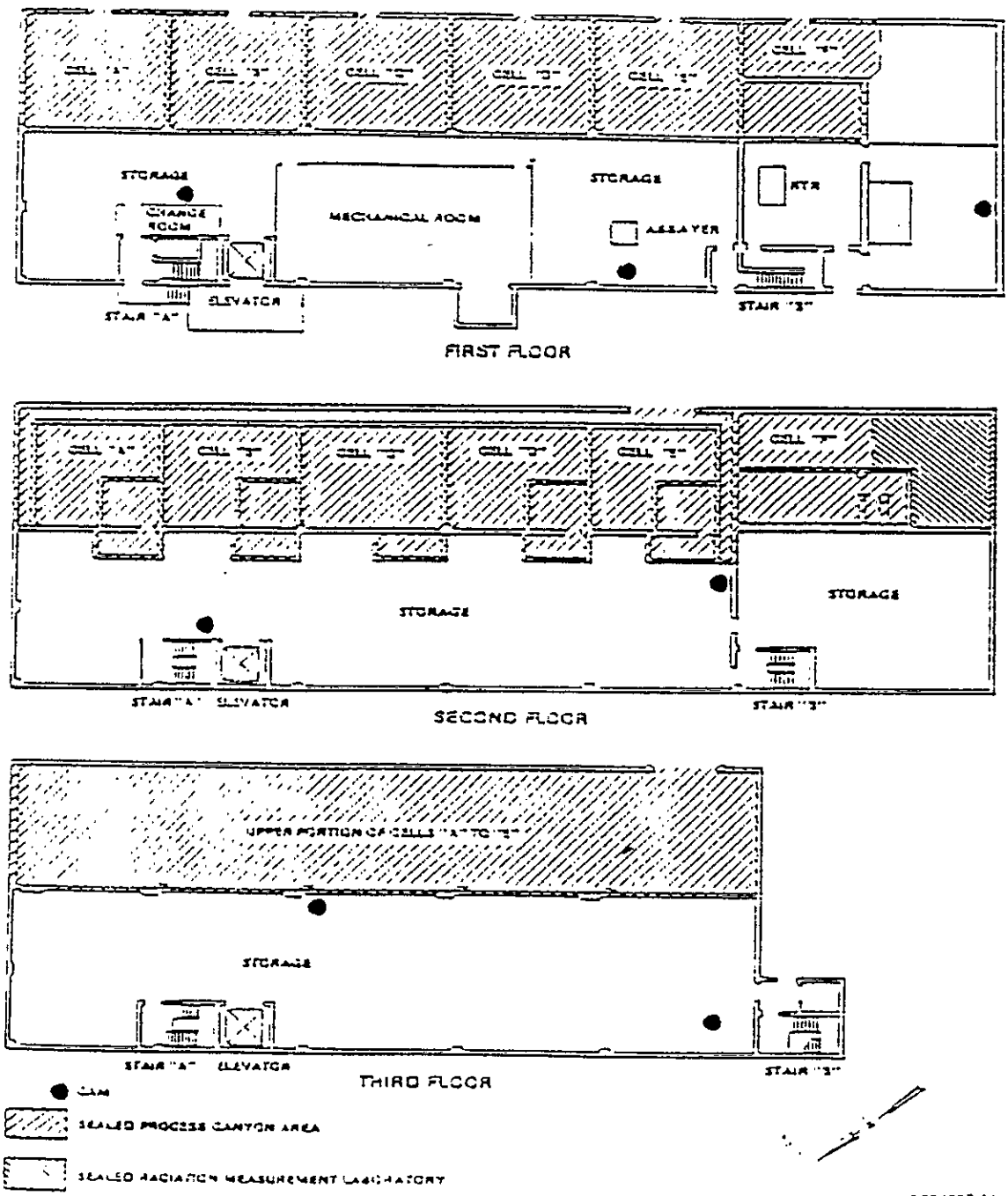
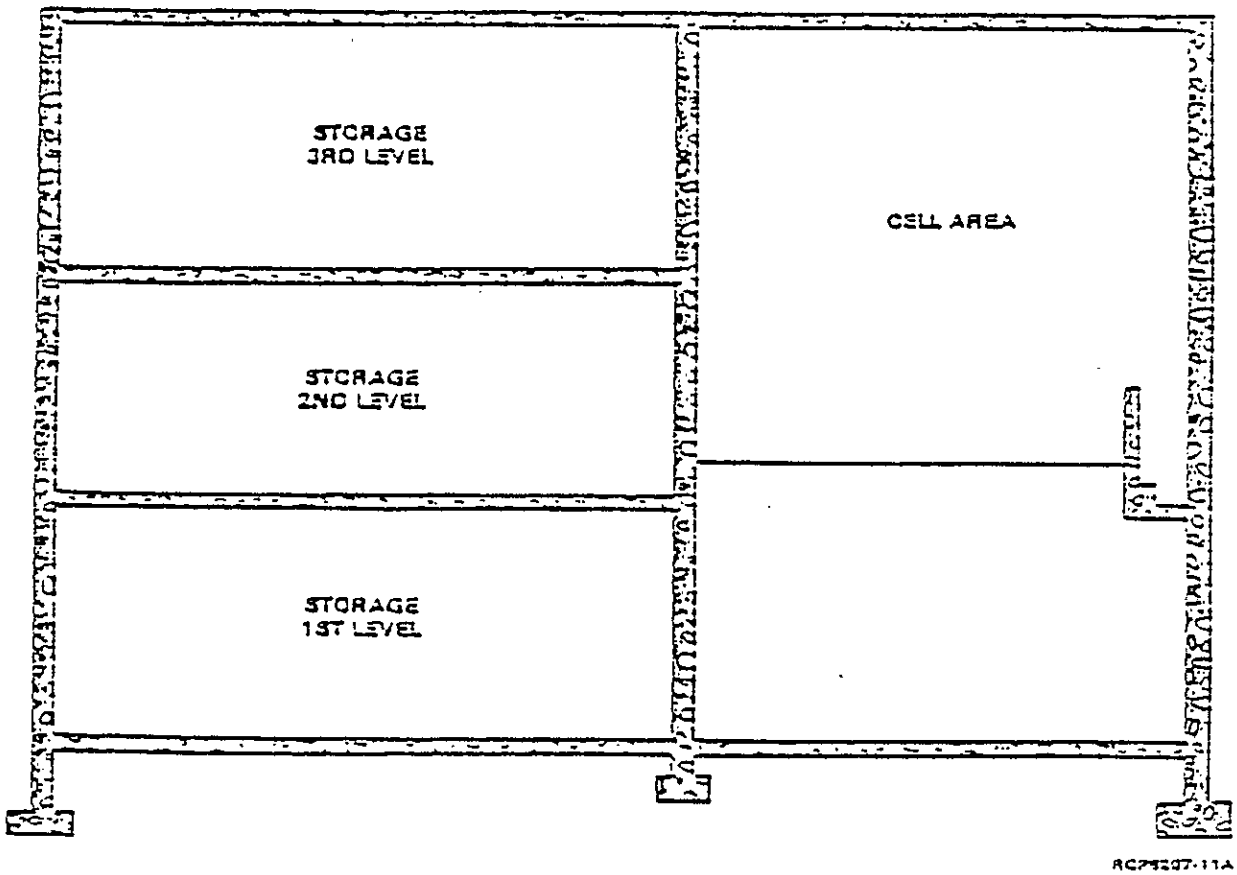


Figure 2. Cross Section of 224-T.



The storage area on the first floor is located in the former gallery area associated with cells A through E. This area contains a toilet, change room, mechanical room, and storage space. The storage space on the first floor is in an open area with arrays marked off or painted on the floor.

The storage space on the second floor is located in the former gallery area associated with cells A through F. The individual process cell sample galleries, which protrude into this area, but are not part of the storage area, are sealed off. Storage on the second floor is in an open area with arrays marked on the floor.

The storage area on the third floor is located in the former operating gallery area associated with cells A through E.

Constant air sampling of operating and storage areas on each of the three floors is provided by continuous air monitors (CAM). The locations of the portable CAMs are shown in Figure 1.

2.2 PROCESS DESCRIPTION

The TRUSAF process flow is depicted in Figure 3 and described in the following paragraphs.

Before shipping any waste packages to TRUSAF, the waste generator contacts the appropriate Westinghouse Hanford Company (Westinghouse Hanford) organization for acceptance criteria, obtains a written burial compliance checklist approval, and schedules shipment to TRUSAF.

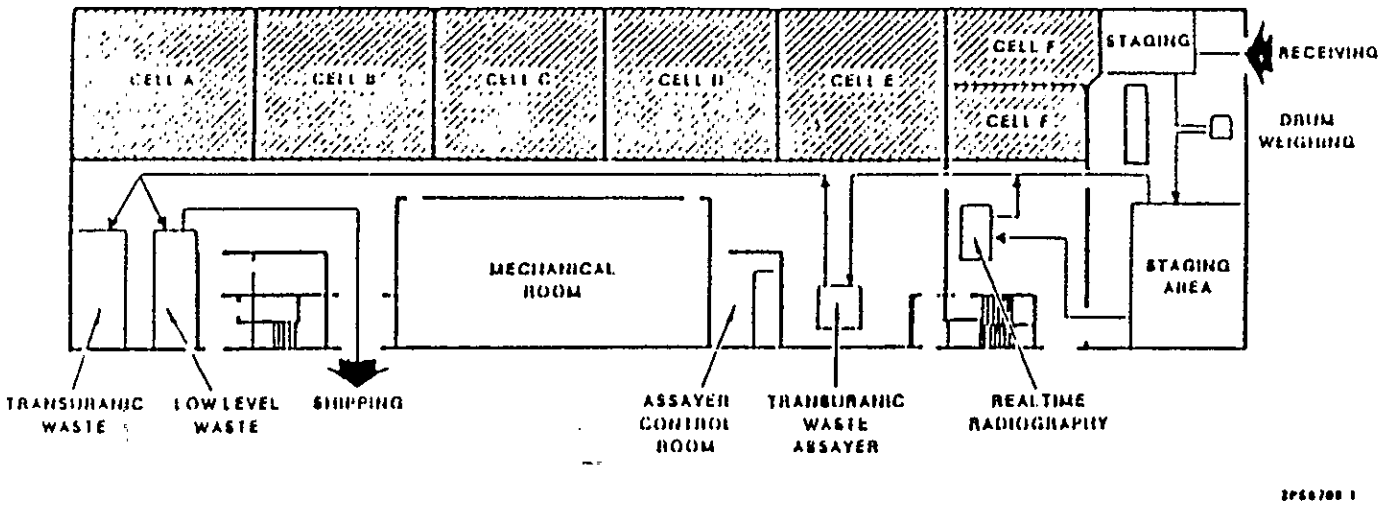
The shipment is received at TRUSAF and is checked for acceptability before it is unloaded. This includes examining the documentation to ensure it is proper and complete. The required documents include a Radioactive Shipment Record, Solid Waste Storage Record, a WIPP Certification Checklist, Nuclear Material Item Transfer or equivalent, and a Contents Inventory Sheet (CIS). Hazardous waste manifests are also required if hazardous constituents are present in the containers.

A health physics technician (HPT) surveys for radiation levels and surface contamination. Acceptable limits are the following:

Radiation levels	<200 mrem/h (exposure)
Smearable contamination	<100 dpm/100cm^2 (alpha)
	<1,000 dpm/100cm^2 (beta-gamma)

The containers are inspected for proper labeling, with attention to hazardous material labels for items that appear on the CIS. Any TRU waste containing hazardous materials is evaluated on a case-by-case basis. Liquid contaminants are strictly prohibited.

Figure 3. TRUSAF Process Flow.



Container integrity is verified; the approved container for TRUSAF is the U.S. Department of Energy (DOE) 17C, 55-gal galvanized drum. Signs of its compromise include bulges, dents, and weather deterioration. Should any discrepancies be discovered, management is notified and the shipment is not accepted until further review or until corrections are made.

During the unloading process, care is taken to avoid damaging the containers. Lift tailgates are used to lower the containers from the transport vehicle and material-handling-equipment weight limits are complied with. Hand carts are used to move the containers to the initial staging area. Signs and barricades are posted around the area to communicate the potential radiation hazard. The drum's identification number and the date are recorded in the Receipt and Storage Logbook. A data package is prepared for each container and accompanies the container throughout the process.

The drums are weighed using a digital weighmeter. The drums are lifted by electric crane equipment with a drum-handling attachment and slowly lowered onto the scale. A printer produces a label with the drum's weight in kilograms. This label is applied to the container. The crane is used to raise the drum off the scale and lower it to the floor.

The container is moved by a hand-operated forklift to the research tecnology radiography (RTR) operating room where it is x-rayed. The RTR system was supplied by Realtime X-Ray Imaging Corporation and consists of a drum manipulator, x-ray equipment, and a video system. The purpose of the RTR is to visually overview the waste and ensure that what can be identified is in general agreement with the documentation.

Using a hand-operated forklift with a drum-handling attachment, the container is loaded into the radiography system. During the examination, the drum can be raised and turned using the manipulator controls. Audio and visual notes are recorded on video cassette tape during the examination to provide real-time imaging. The tape is then labeled with the drum ID number, date, and time.

The drums are assayed to determine TRU activity. The Transuranic Waste Assayer (TWA) was supplied by Los Alamos National Laboratory and uses a combination active-passive neutron interrogation system to determine TRU contents in 55-gal waste drums. The system consists of a shielded assay chamber, a deuterium-tritium neutron generator, helium-3 proportional counters, a drum-handling system, electronics, and a computer/printer system for data acquisition and analysis. The TWA is capable of detecting TRU levels of 10 nCi/g in the waste matrix. Waste containers that assay $\geq$100 nCi/g are considered to be TRU waste. Results from the assay and RTR determine where the drums are temporarily stored. The temporary storage area is located on the first floor and is divided into the following areas:

- Plant Certified Waste (waste from a plant that has an approved certification plan)
- Z-Plant Room Waste or "Suspect"

(The above areas are initial storage locations for drums to be processed.)

- Certified for TRUSAF Storage (drums to be moved to the interim storage areas on the upper floors)
- Noncertifiable WIPP (drums that are not certifiable and are to be sent to the TRU retrievable storage)
- Low-Level (these are drums that assay less than 100 nCi/g TRU activity and are to be relabeled and buried as low-level waste. All existing TRU labels are destroyed to avoid any confusion.)
- Hold (drums that have one or more hold points checked on the Traveler form and are being held for further analysis)
- Return to Generator (drums that have been designated to be returned by the TRUSAF manager).

All TRU waste packages that successfully meet the requirements are placed in interim storage pending shipment to WIPP. Interim storage areas are located on the second and third floor. TRUSAF also plans to received drums that require no overview. They are received as certified waste containers that are sent to TRUSAF for storage only. These containers will be from offsite WIPP waste acceptance criteria-certified generators and will be sent directly to the interim storage area.

The drums are stored in modules with drums stacked no more than two high. Each module is labeled for drum traceability. Each drum has a module recorded in the Receipt and Storage Logbook under the heading of final disposition. A hand-operated forklift is limited by a limit switch. A check of overhead obstruction is done before exceeding the limit. Each tier of drums is separated by a sheet of 1/4-in. minimum-fire-retardant plywood or equivalent. Stacked drums are not to exceed the maximum floor loading; they are as follows:

First floor	2,500 lb/single stack
Second floor	600 lb/single stack
Third floor	800 lb/single stack
Elevator	8,000 lb capacity.

These limits are not exceeded without a structural analysis. The drums are arranged with aisles around the modules to allow for easy access through the storage areas. Drums with thermal wattage in excess of 0.1 W/ft^3 are segregated and stored in single tiers at least 3 ft away from other stored drums.

The drums remain in storage until shipment to WIPP. The anticipated shipping years are 1988 through 2013.

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3.0 STATUS OF OPERATION

The operational status of the TRUSAF is fully active. The primary function or process associated with the TRUSAF is nondestructive analysis and temporary storage of transuranic (TRU) solid-waste packages. Originally, the 224-T building's function was to purify plutonium nitrate by the lanthanum fluoride process. The process cells used for this operation have been decommissioned and isolated, but remain in a sealed portion of the building. The functions or processes associated with these facilities result in the storage and management of radioactive materials and the use, storage, management, and disposal of hazardous materials. The functions or processes associated with these facilities have the potential to generate radioactive and hazardous airborne and liquid effluents.

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4.0 SOURCE TERM

4.1 IDENTIFICATION AND CHARACTERIZATION OF EFFLUENT STREAMS

The primary effluent pathway under normal operating conditions is the facility ventilation system. The ventilation system for the 224-T Building was upgraded when 224-T was converted to a storage facility.

The present 224-T ventilation system is depicted in Figure 4. There are three fans: two exhaust and one supply. Final exhaust filtration consists of 8% National Bureau of Standards prefilters and 99.95% rated efficiency HEPA filters. The HEPA filters are arranged in four banks as shown in Figure 4. Each bank has nine HEPA filters in parallel (i.e., a three-by-three array).

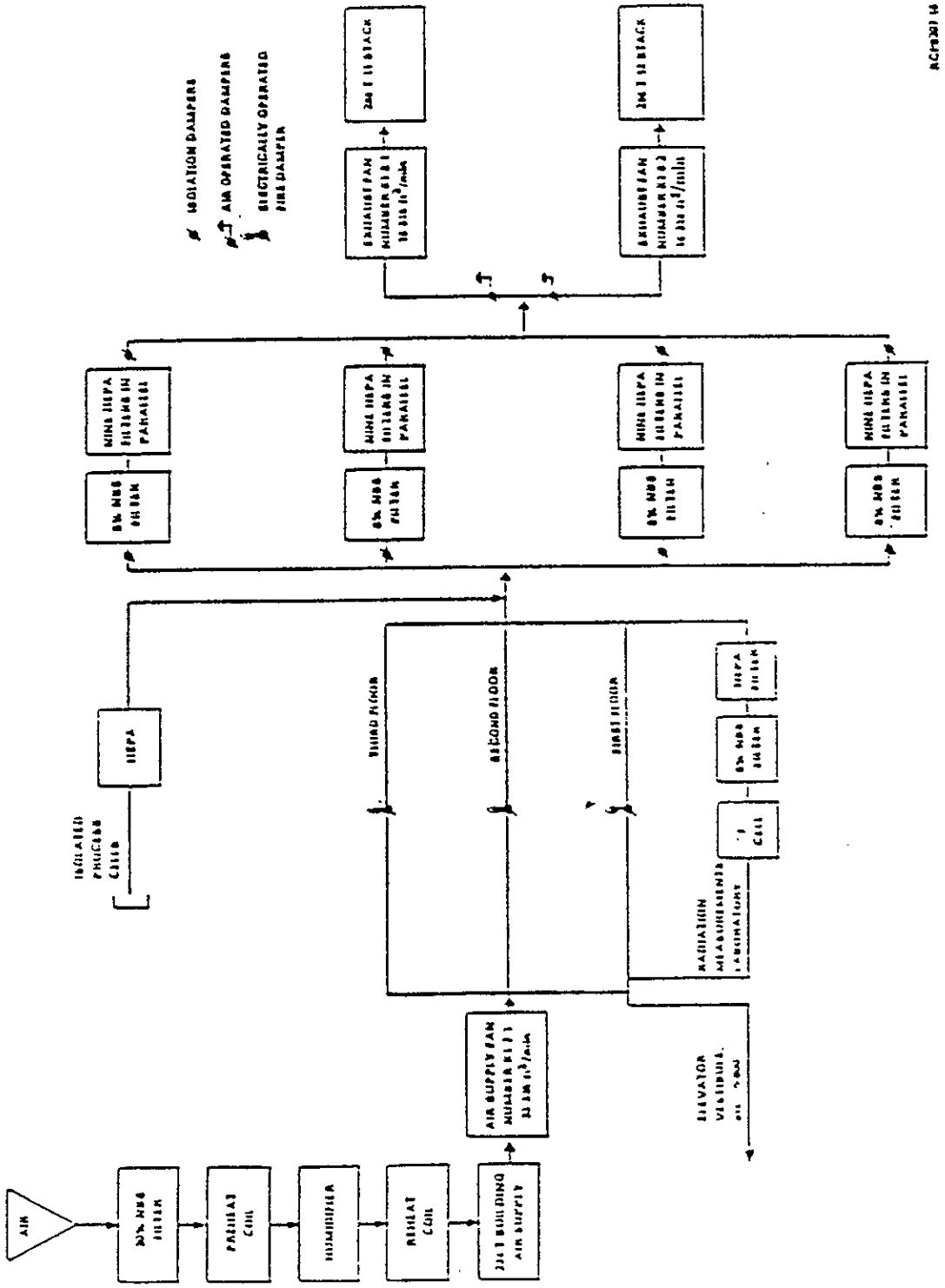
The main air supply to the building is via the supply fan (K1-7-1) at 33,335 ft^3/min supplying all 3 floors of the 224-T Building. The majority of the laboratory air is exhausted via F cell. The F Cell exhaust air is prefiltered and HEPA filtered before joining the common exhaust plenum upstream of final filtration. In addition, approximately 100 ft^3/min of air leaks from the environment via a doorway to the laboratory.

The majority of the air enters a common exhaust plenum from which it flows through prefilters and HEPA filters before being exhausted to the atmosphere. Some air, approximately 800 ft^3/min, is exhausted to the environment, unfiltered (via stairways), to the elevator, a vestibule, and a lavatory, which are not tied into the main building exhaust system. The filtered air is exhausted by parallel exhaust fans (K1-8-1 and K1-8-2) at a nominal rate of 16,318 ft^3/min each. Filtered air is discharged to the atmosphere via Stacks 296-T-11 and 296-T-12. The stacks, located on the southwest end of the second floor roof of Building 224-T, are horizontal and exhaust toward the southwest. The isolated process cells are maintained at a negative (-0.8 wg) pressure with respect to atmosphere and to the storage areas (-0.5 wg) by venting through one stage of HEPA filters and tying into the building ventilation system ahead of the final stage of prefilter and HEPA filters. This system provides nine air changes/h.

Each filter in 4 banks of 9 filters arranged as parallel 3-stage (36 HEPA filters) is independently diocryl phthalate (di-2-ethyl hexyl phthalate) (DOP) tested. This provides a decontamination factor (DF) of 8×10^{12} for the air flow from the additionally HEPA filtered, sealed process cells. The DF for air from the storage areas is 4×10^{9}.

Storage of TRU in the 224-T Building does not result in radiological liquid waste or effluents. Steam condensate from the preheat coils and water from the restrooms are the only nonradiological wastes normally released to the environment.

Figure 4. The Heating, Ventilation, and Air Conditioning System for 244-T.



4.2 IDENTIFICATION AND CHARACTERIZATION OF SOURCE TERMS CONTRIBUTING TO EACH EFFLUENT STREAM

When the 224-T Building was converted to store plutonium scrap in 1971, the process cells were sealed and isolated from the operating gallery and service areas. The cells are radioactively contaminated up to 20,000 counts/min. These cells are now maintained at a negative pressure by venting through a HEPA filter into the building offgas system. The majority of this contamination is fixed and is a negligible contributor to airborne effluent.

Currently 224-T is operated as a storage facility for TRU waste. The approved storage container is DOT 17C, 55-gal galvanized drum. Westinghouse Hanford's radioactive solid waste acceptance criteria manual, WHC-EP-0063-2 (Willis 1990), defines TRU waste as follows:

> "Without regard to source or form, TRU waste contaminated with alpha-emitting TRU radionuclides with half lives >20 yr and in concentrations >100 nCi/g of the waste matrix at the time of assay. The TRU nuclides are nuclides having an atomic number >92. In addition to TRU radionuclides, radium sources and ^{233}U in concentrations >100 nCi/g of the waste matrix are designated TRU waste because of hazards similar to TRU waste."

Requirements specified in WHC-EP-0063-2 (Willis 1990) relevant to characterizing potential source terms are as follows:

- Packages of TRU waste shall contain no hazardous wastes unless they exist as cocontaminants with the TRU waste.
- All packages for TRU waste shall provide at least two containment barriers to prevent the release of contamination.
- Powders, ashes, and similar particulate waste materials shall be immobilized if more than 1 wt% of the waste matrix is in the form of particles below 10 μm in diameter, or if more than 15 wt% is in the form of particles below 200 μm in diameter.
- Liquids in TRU waste will not be accepted. Liquids shall be solidified, absorbed, or otherwise bound in the waste matrix by inert materials.
- Pyrophoric materials present in TRU waste shall be rendered safe through processing to remove the hazardous properties.
- Packages of TRU waste shall contain no explosives or compressed gases.
- Fissile material content of individual packages shall not exceed the following in ^{239}Pu fissile gram equivalents: 200 g/55-gal drum or 100 g in drums that are lead lined, contain absorbed organics, or where the fissile material is stored within <20% of the drum volume.

- The ^{239}Pu equivalent TRU activity of individual waste packages shall not exceed 1,000 PE-Ci.

- Waste packages shall have a maximum surface dose rate at contact no greater then 200 mrem/h (beta, gamma, and neutron) at any point.

- Waste packages shall have removable surface contamination no greater than 50 pCi/100 cm^2 for alpha-emitting radionuclides and no greater than 450 pCi/100 cm^2 for beta-emitting radionuclides.

All waste received at TRUSAF is subject to the definitions and requirements listed above. Any waste not meeting the necessary requirements is returned to the generator. Documentation required from the generator coupled with the results of radiographic and assay procedures performed at TRUSAF combine to produce a reasonably accurate profile of the contents of each waste container. The definitions and requirements listed serve as bounding conditions to characterize potential source terms. Following standard practices for safety analysis reports and hazards analyses, the container inventories will be treated in terms of ^{239}Pu equivalent curies.

4.3 EFFLUENT POINT OF DISCHARGE DESCRIPTION

The primary effluent points for the 224-T Building are the 296-T-11 and 296-T-12 stacks. The stacks, located on the southwest end of the second floor roof of Building 224-T, are horizontal and exhaust toward the southwest. Filtered air is discharged to the atmosphere by parallel exhaust fans (K1-8-1 and K1-8-2) at a nominal rate of 16,318 ft^3/min each. The TRUSAF readiness review determined that operation did not warrant CAMs on the stack exhausts. However, both stacks have record samplers installed to document release/nonrelease for reporting purposes.

4.4 EFFLUENT MONITORING/SAMPLING SYSTEM DESIGN CRITERIA

It was determined during the readiness review for TRUSAF that the operation did not warrant CAMs on the stack exhausts. However, record samplers are installed on stacks 296-T-11 and 296-T-12 to document release/nonrelease for reporting purposes.

The record samplers installed at 224-T were designed to meet criteria developed in 1985 as part of a 200 Area stack monitor-sampler systems upgrade program. The general design criteria for the record sampler system components are as follows:

- **Sample Extraction Probes.** Isokinetic probe designed to meet the guidelines presented in ANSI N13.1 (ANSI 1969). The probe is to be designed for representative/isokinetic sample extraction based on the average stack velocity.

- **Stack Flow Totaling.** The stack flowrate monitoring system shall have a flowrate sensing element located in the stack in a location that will not interfere with the effluent sample extraction probe. Flow probe sensing lines shall be protected from moisture condensation.

- **Sample Transport Lines.** Shall be selected and installed to minimize particle loss attributed to gravity settling, turbulent impaction, and electrostatic effects. Sample transport line bend radii shall be at least 10 times the inside diameter of the transport line. Provisions shall be made to inhibit moisture condensation in the sample transport lines.

- **Power Coordination and Backup.** The stack sampler-monitor system shall operate continuously using the same emergency electrical power backup capabilities as the stack blower fan(s). An elapsed-time meter shall be ganged with stack blower fan operation to provide a measure of exhaust-stack operation times. The record sample vacuum pump shall be ganged to exhaust fan operation.

- **Record Sampling.** The record sample airstream shall be routed through a 47-mm filter to obtain a buildup sample for laboratory analysis. A flowrate regulator shall be provided to maintain a constant flowrate through the collection filter assembly to compensate for filter loading effects. The record sample flowrates shall be sized to provide optimum samples for laboratory analysis. The product of the sample flowrate (in ft^3/min) and the sample collection time (in hours) shall be at least 370 ft^3/h. Sample flowrates shall not exceed 4 ft^3/min to maintain filter and sample integrity.

4.5 CHARACTERIZATION OF CURRENT EFFLUENT MONITORING SYSTEMS

The record sampler system installed at TRUSAF conforms to the design criteria listed in Section 4.4. Figure 5 is a system flow diagram. The installed sample probes are sized to provide near isokinetic sampling for 2.2 ft^3/min sample extraction rate and stack flow velocities of 2,613 ft/min for stack 296-T-11 and 1,850 ft/min for stack 296-T-12. The flow totalizer is certified accurate to $\pm$ 10% and the flowmeter is certified accurate to $\pm$ 5% at 2.2 $stdft^3$/min.

4.6 HISTORICAL MONITORING/SAMPLING DATA FOR EFFLUENT STREAMS

Tables 1 and 2 contain historical alpha and beta discharge data as recorded by the record samplers for 296-T-11 and 296-T-12 from 1985 when the facility began operation as TRUSAF until 1989, which is the most recent summary available to date.

Figure 5. Flow Diagram.

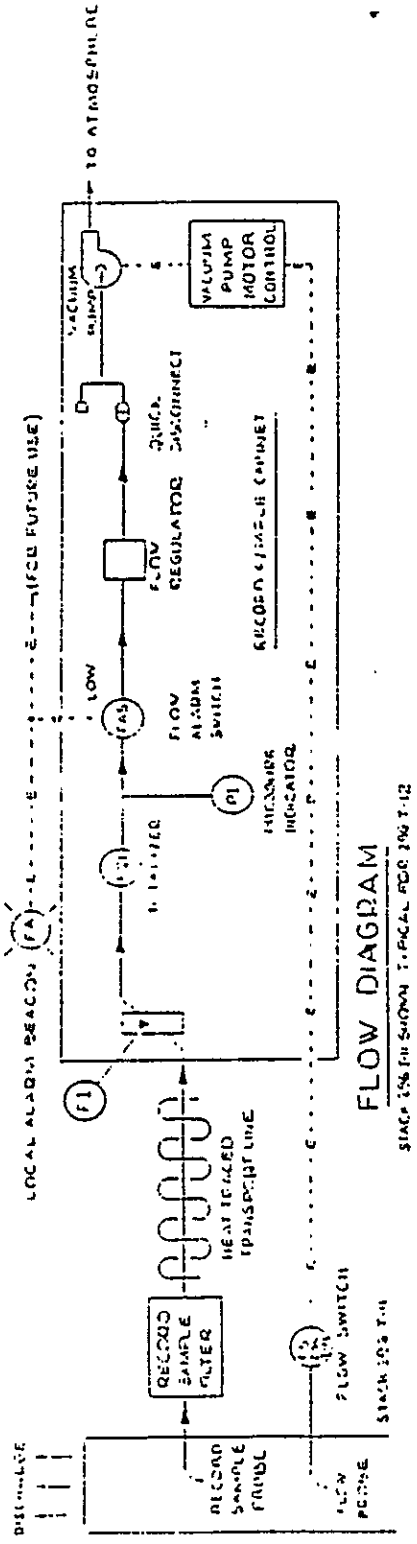


Table 1. Historical Gross Alpha and Beta Discharge Data for Stack 296-T-11.

Year	Volume (L)	Activity (Ci)	
		Alpha	Beta
1985	2.07 E+11	<7.73 E-07	<6.50 E-06
1986	2.04 E+11	<7.27 E-07	<2.73 E-06
1987	1.94 E+11	<6.80 E-07	<3.00 E-06
1988	1.97 E+11	<6.90 E-07	<2.37 E-06
1989	1.83 E+11	<6.46 E-07	2.60 E-06

Table 2. Historical Gross Alpha and Beta Discharge Data for Stack 296-T-12.

Year	Volume (L)	Activity (Ci)	
		Alpha	Beta
1985	12.08 E+11	<7.29 E-07	6.16 E-06
1986	1.99 E+11	<6.96 E-07	<2.98 E-06
1987	1.92 E+11	<6.71 E-07	<2.35 E-06
1988	1.67 E+11	6.94 E-07	<2.33 E-06
1989	1.49 E+11	<5.20 E-07	<3.70 E-06

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5.0 POTENTIAL UPSET-OPERATING CONDITIONS

The potential radioactive airborne effluent releases during routine operating conditions have been evaluated. The TRUSAF receives solid TRU waste that has been packaged and sealed. Nondestructive analysis is performed on the closed waste packages to verify compliance with the WIPP waste acceptance criteria. Those containers meeting WIPP waste acceptance criteria are stored in the building; those determined to be low-level waste are transferred to the burial trenches, and those having deficiencies are returned to the generators or stored in the 200 West Area for future processing. All wastes received are packaged in accordance with the Hanford Site radioactive solid waste acceptance criteria. These criteria require that all packages for TRU waste storage provide at least two containment barriers. They also prohibit liquids in packages unless bound in the waste matrix by inert materials (Willis 1990). There are no airborne releases from routine operations.

The upset condition for the facility to generate radioactive airborne effluent releases can be described as receipt of a package that leaks. An event that would bound this type of upset was analyzed in a facility safety analysis report. The postulated event was a 200-g spill of PuO_2 where 0.05% is released to the atmosphere when a drum fell from a truck and the lid was removed. The maximum consequence to an individual offsite was 0.026 mrem/yr.

No information was available on the contents of the abandoned lanthanum fluoride process cells that have been sealed. These cells are ventilated. The exhaust is controlled with its own HEPA filter and then combined with the other building HVAC streams just before they enter the main bank of building National Institute of Standards Technology (NIST) (Formerly National Bureau of Standards [NBS])-filters and HEPA filters. Routine or upset releases could not be postulated.

The potential radioactive airborne effluent releases during both routine and upset facility operating conditions has been evaluated. The evaluation indicates the radiation effective dose equivalent (EDE) to the maximally exposed member of the public would be less than 0.1 mrem/yr, which represents 1% of the radioactive airborne effluent release limit standard of 10 mrem/yr. Based on the data, it appears that a FEMP would not be required for this release pathway. However, the lack of information on the isolated process cells would mandate additional conservatism. A FEMP should be prepared for this release pathway unless more information can be provided on the isolated cells.

The upset condition for the facility to generate hazardous airborne effluent releases can be described as a spill of a volatile material that becomes entrained in the building exhaust. Washington State's Dangerous Waste Regulations mandate that any discharge to the environment of a dangerous waste or hazardous substance be reported (Washington Administrative Code [WAC] 173-303-145 [WAC 1989]). The regulation does not specify a de minimus quantity. No volatile materials are stored in Building 224-T.

The potential radioactive liquid effluent releases during routine and upset operating conditions have been evaluated. Operating practices that only involve handling sealed containers preclude liquid effluent releases from routine operations. A waste acceptance criteria that prohibits free liquids and mandates a minimum of two barriers would require at least three simultaneous failures to produce a liquid release. Multiple failures are outside the scope of upsets as defined for the FEMP determination.

Information on the potential radioactive liquid effluent releases during both routine and upset facility operating conditions indicates the radiation EDE to the maximally exposed member of the public consuming the water would be less than 4 mrem/yr, which represents a dose limit from a radionuclide or mixture of radionuclides at a level of 4% of the Derived Concentration Guide value. Based on the data, it appears that a FEMP is not required for this release pathway.

The only chemical stored in the facility is 1 lb of potassium hydroxide. The relevant reportable quantity is 1,000 lb. Number 6 fuel oil is listed in the facilities chemicals inventory. The fuel oil is likely to contain benzene as a hazardous constituent. Washington State's *Dangerous Waste Regulations* mandate that any discharge to the environment of a dangerous waste or hazardous substance be reported (WAC 173-303-145 [WAC 1989]). The regulations do not specify a de minimus quantity. Benzene is classified by Washington State as a dangerous waste constituent (WAC 173-303-9905 [WAC 1989]).

Information on the potential hazardous liquid effluent releases during routine and upset facility operating conditions indicates that the quantities of hazardous materials at the point of discharge to the environment may exceed applicable reportable quantities for regulated substances. Specific information is presented in Attachment 1. Based on the data, it is recommended that a FEMP be prepared describing the effluent monitoring requirements for hazardous liquid effluent releases.

5.1 LOCATION OF MATERIAL DURING ROUTINE OPERATING CONDITIONS

During routine operations, waste containers are located in either the receiving area, the radiography area, the assay area or one of the storage ares. Because of the very low levels of removable contamination allowed on the containers, routing handling is not anticipated to produce significant airborne contaminants. Contamination in the sealed process cells is primarily fixed and is not likely to be disturbed during routine operations. The fuel oil used to run the emergency steam plant boiler is stored outside the building in two 300-gal double-walled storage tanks. No routine operations are performed that are expected to produce radioactive or nonradioactive effluents.

5.2 LOCATION OF MATERIALS DURING UPSET CONDITIONS

Other than producing the potential for releasing material to the environment, upset conditions will cause no significant alteration in the distribution of materials within the facility from that described for normal operations.

Credible upset conditions considered for this report include loss of HVAC, loss of HEPA filtration, dropping of a drum (worst case), and activation of the fire suppression system. Loss of ventilation by power or equipment failure is not considered critical. Wastes are stored in approved containers and, although an increase in ambient air temperature would be expected, it would not be enough to threaten container integrity.

A loss of HEPA filtration would allow building air to be exhausted directly to the atmosphere. The *Westinghouse Hanford Company Effluent Discharge and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, WHC-EP-0141-2 (WAC 1990), lists the annual isotopic release data for the TRUSAF exhaust points shown in Table 3.

Table 3. Annual Isotopic Release Data.

	Curies	
	$^{239,241}Pu$	^{241}Am
296-T-11	<2.53 E-07	<3.73 E-07
296-T-12	<1.71 E-07	<3.43 E-07
Total	4.06 E-07	7.16 E-07

If these values are increased by a factor of 3,000 to account for the loss of filtration they become: 1.2×10^{-3} Ci of $^{239,241}Pu$ and 2.1×10^{-3} Ci of ^{241}Am. A ground-level release in the 200 West Area would result in the 50-yr committed EDE for the maximally exposed offsite individual shown in Table 4.

Table 4. Fifty-Year Committed Effective Dose Equivalent for $^{239,241}Pu$ and ^{241}Am.

	GENII (mrem)	CAP88 (mrem)
$^{239,241}Pu$	4.3 E-03	6.2 E-03
^{241}Am	1.2 E-02	1.6 E-02
Total	1.6 E-02	2.2 E-02

The maximum discharge values for gross alpha and beta starting with 1985, when the facility began operation as TRUSAF, to the most currently available data can be determined. They are as follows: 7.73×10^{-7} Ci alpha and 6.50×10^{-6} Ci beta for 296-T-11 and 7.29×10^{-7} alpha and 6.16×10^{-6} beta for 296-T-12. The Total maximum value is the sum of these values and equals

1.50×10^{-6} alpha and 1.27×10^{-5} beta. Considering the worst case, it will be assumed that the alpha discharge is all ^{239}Pu and the beta discharge is all ^{90}Sr. If these values are increased by a value of 3,000 to account for the loss of filtration they become: 4.50×10^{-3} Ci of ^{239}Pu and 3.81×10^{-2} Ci of ^{90}Sr. The following 50-yr committed EDEs for the maximally exposed offsite individual are listed in Table 5.

Table 5. Fifty-Year Committed Effective Dose Equivalent for ^{239}Pu and ^{90}Sr.

	GENII (mrem)	CAP88 (mrem)
^{239}Pu	1.6 E-02	2.3 E-02
^{90}Sr	7.6 E-04	1.0 E-03
Total	1.7 E-02	2.4 E-02

All of the values calculated for loss of HVAC are below the value of 0.1 mrem requiring a FEMP.

The TRUSAF areas of the 224-T Building are protected by an automatic dry-pipe sprinkler system using ionizing-type detectors. The sealed process cells are not protected by an installed sprinkler system; however, they are isolated and free of combustibles. Activation of the sprinkler system either though detection of a fire or inadvertently could result in discharge of a radioactive effluent. The storage rooms are designed to hold 2 in. of water before the water could spill into the elevator shaft and outside of the building. All of the floor drains in the 224-T Building have been sealed off. The amount of water that could accumulate in the storage areas before spilling over the 2-in. ledge is approximately 15,000 gal. This would allow the accumulation of 1 h of water in the case of three sprinkler heads operating on the second or third floor or two sprinkler heads operating on the first floor. The fire department would be expected to respond within 5 to 10 min to turn off the water. It is unlikely that water would accumulate to the point of overflowing the 2-in. threshold before mitigating actions are taken. Potentially contaminated water would then be analyzed before disposal.

The worst-case event that is postulated for TRUSAF is the release of the contents of one or more drums. The movement of drums provides the highest potential for a release. The drums are moved with a walking forklift and the drums are stacked no higher than two tiers. The most credible upset during drum movement, with a walking forklift, is dropping a pallet with four drums. The drums are designed to withstand incidents associated with transportation. Dropping of drums (worst case) would not result in a puncture of the drum. It will be assumed that a drum falls from a truck in such a manner that the lid is removed and the plastic wrappings containing 200 g of PuO_2 is spilled and ruptured. It is further assumed that the PuO_2 is in dispensable form and that the impact results in lofting 0.05% of the PuO_2; then, 0.1 g of Pu is released as a small puff. If this occurs in the unloading area with the outside door open, no reduction will be applied for filtration. From WHC-EP-0063-2 (Willis 1990), the equivalent curie (Pe-Ci) content of 1 g of Plutonium isotopes is 0.0869 PE-Ci. Therefore the release of 0.1 g of Pu is equivalent to 0.0087 PE-Ci. Therefore, a ground-level release in the 200 West Area would

result in the following 50-yr committed EDE for the maximally exposed offsite individual: 3.1×10^{-2} mrem for GENII and 4.5×10^{-2} mrem for CAP88.

In 1991, a portable emergency steam plant was located at 224-T to supply building steam for building heating in the event steam from the main supply was lost. The plant is fueled by number 2 diesel fuel, which is contained in two 300-gal tanks. The tanks are double walled and all connections are made through the top of the tank. The tanks are located on the northwest side of the building and sit on the asphalt surface bordering this side of the building. A credible upset condition would be a spill of liquid caused by a leak in one of the control or feed lines. In December 1990 a leak in an oil pressure gauge line caused approximately 30 gal of diesel fuel to spill. However, this plant is scheduled for removal before November 1991.

Under normal operating conditions no effluents would be expected from the sealed-off cell portion of the building. Even if it were assumed that all releases recorded in 1989 were from the cell portion of the building, the resulting dose is well below the value of 0.1 mrem, which would require a FEMP. No credible upset conditions affecting the cell portion of the building could be postulated that would result in a release to the environment.

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6.0 ADDITIONAL INVESTIGATIONS

6.1 ORGANIC MONITORING FOR TRANSURANIC WASTE STORAGE AND ASSAY FACILITY

Initial data gathered indicated that a full-scale FEMP may not be required. To verify this finding, it was recommended that air emission samples be taken at the facility. Therefore, air samples were collected and analyzed to determine the presence or absence of organic air emissions. A two-phase sampling approach was proposed. This section provides a discussion of the technical approach and results from Phase I.

6.2 PHASE I SAMPLING

The selected target compounds and the estimated detection limit are listed in Table 6. For compounds analyzed and reported in Phase I, the vendor reports listed a detection limit. For compounds to be analyzed in Phase II, this limit was calculated from vendor literature that related the length of time the sampler would have to be exposed to the target atmosphere to detect the time-weighted average-permissible exposure limit. For example, if the monitor required 8 h to detect 240 ppm, the estimated detection level for a 24 h exposure would be 240/3 = 80 ppm.

6.2.1 Methodology

Passive adsorption type air monitors were chosen for this task. The cartridges are loaded with a charcoal adsorbent and separated from the air by a porous membrane. The passive monitors were obtained from Advanced Chemical Sensors Company of Pompano Beach, Florida and 3M Company of St. Paul, Minnesota. The organic vapor enters the monitor by diffusion and is adsorbed onto the charcoal adsorbent. At the end of the sampling period, the monitor is sealed in a bag or can to terminate sampling and returned to the laboratory for measurement and calculation.

At the laboratory, the adsorbed organic chemical is generally desorbed into a solvent suitable for gas chromatographic analysis and subsequently analyzed to obtain the weight of organic chemical adsorbed. Benzene was analyzed by infrared spectrometry. Application of known diffusion/adsorption rates allows calculation of a time-weighted concentration average in the air sampled.

6.2.2 Sampling Placement

The sampling points chosen are indicated on Figures 6, 7, and 8 and described in Table 7. The sample location numbering system consisted of two numbers separated by a hyphen. The first of the two numbers reflects the floor being sampled (1, 2, or 3), the second number is a sequential number designating the individual sampling location. The monitors were hung on wire racks approximately 5 to 6 ft high.

Table 6. Selected Target Compounds.

Target Compounds of Interest/MDL	Passive Monitor Available	TWA-PEL (ppm)	Study Phase
1. Acetone[1]/7 ppm	Yes	750	1
2. Benzene[1]/0.1 ppm	Yes	1	1
3. Carbon Tetrachloride (CCl_4)[1,2]/0.02 ppm	Yes	2	1
4. Chloroform ($CHCl_3$)[3]/0.02 ppm	Yes	2	1
5. Kerosene[3,5]			
Hydrocarbons			
Hexane, Heptane, Octane, Nonane, etc./0.06	Yes	50[6]	1
Diphenyl (phenyl benzene)/0.006	No	0.2	--
Naphthalene/3.3 ppm	Yes	10	2
6. MEK (methyl ethyl ketone, 2-Butanone, methyl acetone)[4]/1.7 ppm	Yes	5	2
7. Mercury[2]/0.017 mg/m	Yes	0.05 mg/m	2
8. Methylene Chloride[1]/1.0 ppm	Yes	500	1
9. MIBK (methyl-isobutyl ketone, hexone)[3,4]/0.07 ppm	Yes	50	1
10. Tributyl Phosphate[2,3]/0.005 ppm	No	0.2	2
11. Trichloroethylene[1]/0.1 ppm	Yes	50	1
12. Toluene[1]/0.3 ppm	Yes	100	1
13. Xylene[3,4]/0.05 ppm	Yes	100	1

[1]Compounds requested by Westinghouse Hanford staff.
[2]On inventory listings.
[3]Process knowledge.
[4]MSDS Amercoat (Amercoat listed on inventory).
[5]MSDS Kerosene, Total hydrocarbons analyzed in Phase I.
[6]Example based on hexane.

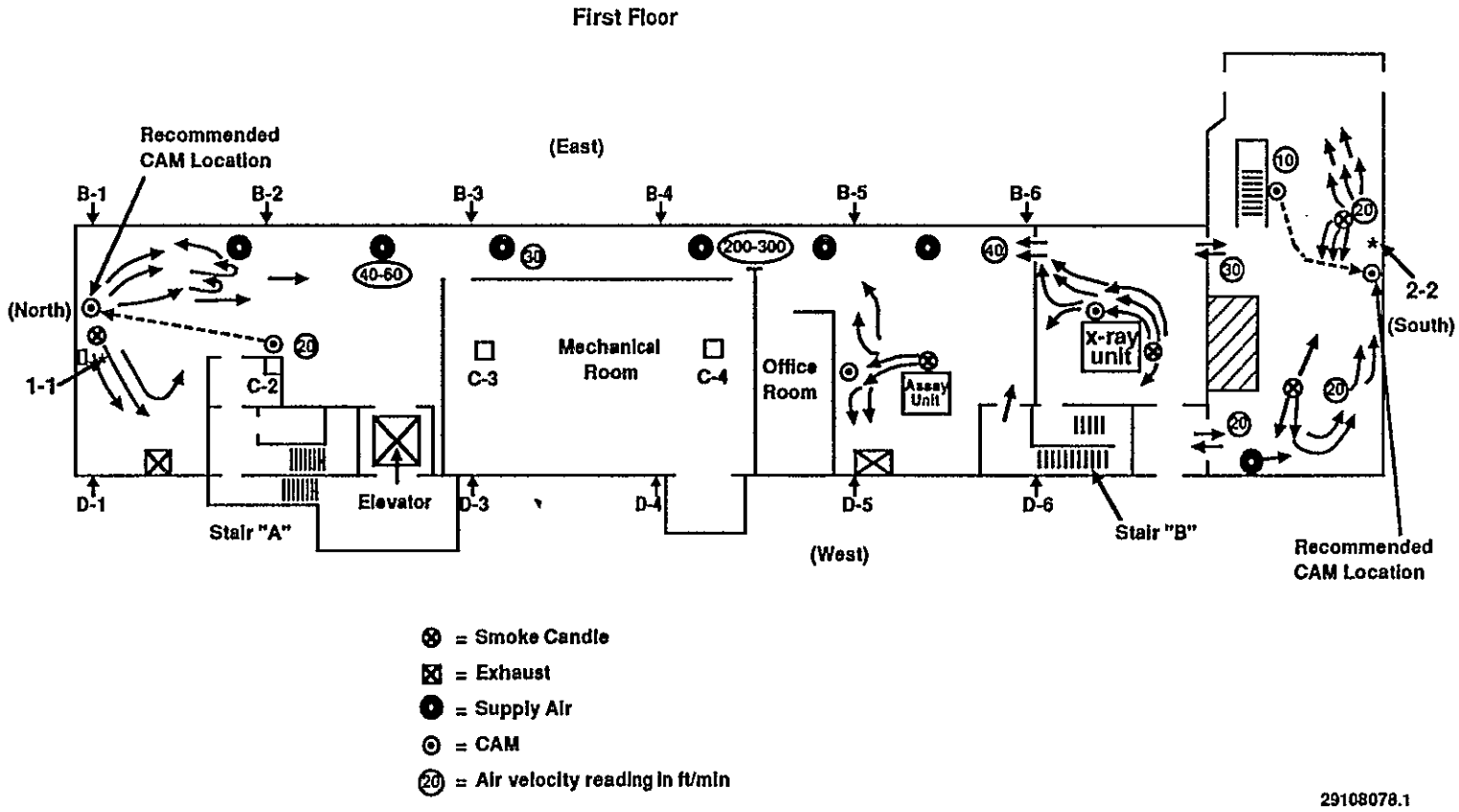
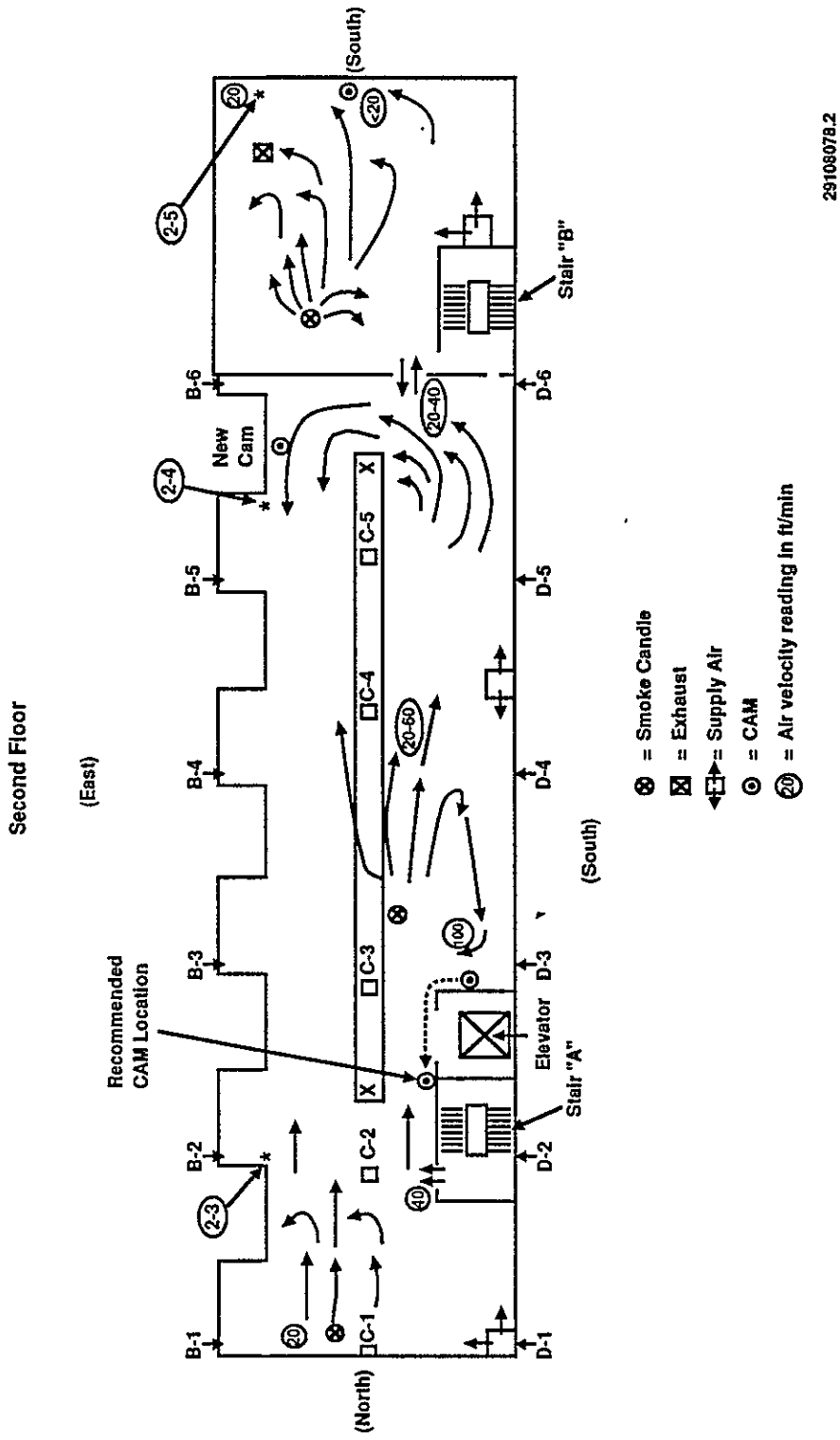


Figure 6. First Floor Schematic.

Figure 7. Second Floor Schematic.



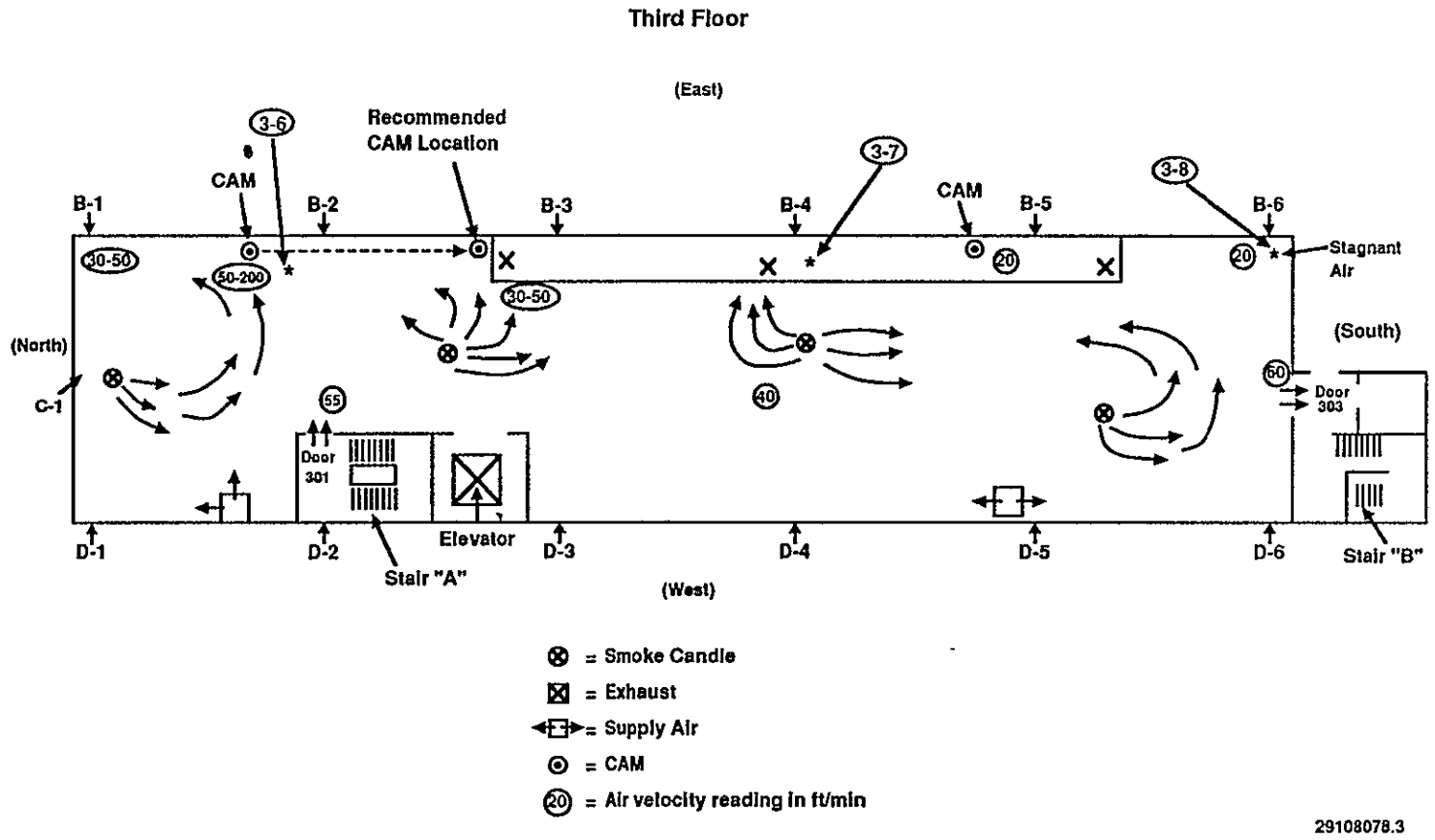


Figure 8. Third Floor Schematic.

Table 7. Description of Transuranic Waste Storage and Assay Facility Sampling Location.

Location	Description
1-1	On the north end of the 1st floor, approximately 5 ft south of column C-1
1-2	On the south wall of the 1st floor, approximately 10 ft west of the scales
2-3	On the north end of the 2nd floor by column B-2, approximately 10 ft from the east wall
2-4	On the east side of the 2nd floor between columns B-5 and B-6, approximately 8 ft from the east wall
2-5	On the south end of the 2nd floor in the corner by column B-8, approximately 5 ft from the south wall and 8 ft from the east wall
3-6	On the north end of the 3rd floor near column B-2, approximately 3 ft from the east wall
3-7	On the east side of the 3rd floor near column B-4 on an unused CAM stand about 1 ft from the east wall
3-8	On the south end of the 3rd floor near column B-6, approximately 11 ft from the south wall and 11 ft from the east wall

The date, time, location, monitor I.D., target compounds, and comments were recorded on a data log at the time of monitor placement. The date and time sampling was terminated was recorded on the Data Log when the samplers were picked up approximately 23 h later. All monitors were surveyed for unconditional release by a Westinghouse Hanford HPT before removal from the facility.

6.2.3 Quality Assurance/Quality Control

Blank and calibration standards are run with each analytical batch in the laboratory and estimates of precision and accuracy are supplied by the Organic Vapor Monitor Vendors. A trip blank and an equipment blank were also prepared for selected organics (xylene, methyl-isobutyl ketone (MIBK), total hydrocarbons). The analysis blank, calibration standards, trip blank, and equipment blank are similar to quality control (QC) reference samples as defined in WHC-EP-0446 (WHC 1991) and U.S. Environmental Protection Agency (EPA) SW-846 (EPA 1982). Analysis results are evaluated with regard to the overall system accuracy. Vendors comply with Occupational Safety and Health Administration (OSHA) requirements of ±25% overall system accuracy with 95% confidence limits.

6.2.4 Results

The results of the Phase I air monitoring task are presented in Tables 8a through 8d. Each table lists the target compounds and selected synonyms, sampling time, results, and sampling locations for one floor. The sampling and analysis results will be discussed by compound.

Acetone. Acetone was not detected above the maximum detection limit (MDL) of 7 ppm.

Benzene. Benzene was found on all three floors between 1.1 and 1.9 ppm. The detection level for benzene via this method is reported as 0.1 ppm. Discussions with the analyst at the service laboratory revealed that the batch blank run at the laboratory did not show any contamination that would indicate contamination of the adsorbent lot that the monitors came from. The analyst noticed the presence of significant adsorbed water vapor on the monitors, but did not think it would have significantly affected the infrared measurement of desorbed benzene.

Carbon Tetrachloride. Carbon tetrachloride was detected on all three floors between 0.04 and 0.15 ppm. The MDL for carbon tetrachloride via this method is reported as 0.02 ppm. Thus, although the levels are very low, they would appear to be significant.

Chloroform. Chloroform was detect on all three floors at 0.04 to 0.23 ppm. The MDL for chloroform via this method is reported as 0.02 ppm. Thus, although the levels are very low, they would appear to be significant.

Table 8a. Results of Phase I Monitoring, First Floor.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	23	0.64 0.95	No No	1-1 1-2
Benzene/0.1 (Benzol, Phenyl hydride)	23	1.9 1.9	Yes Yes	1-1 1-2
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	23	0.15 0.06	Yes Yes	1-1 1-2
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	23	0.23 0.14	Yes Yes	1-1 1-2
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	23	0.132 0.116	Yes Yes	1-1 1-2
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	23	1.6 1.4	Yes Yes	1-1 1-2
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	23	<0.071 <0.071	No No	1-1 1-2
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	23	0.15 0.06	No No	1-1 1-2
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	23	0.07 0.11	No Yes	1-1 1-2
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	23	<0.053 <0.053	No No	1-1 1-2

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.

Table 8b. Results of Phase I Monitoring, Second Floor.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	23	0.4 1.1 1.0	No No No	2-3 2-4 2-5
Benzene/0.1 (Benzol, Phenyl hydride)	23	2.0 1.6 1.3	Yes Yes Yes	2-3 2-4 2-5
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	23	0.06 0.07 0.04	Yes Yes Yes	2-3 2-4 2-5
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	23	0.14 0.07 0.08	Yes Yes Yes	2-3 2-4 2-5
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	23	<0.063 0.094 0.068	No Yes Yes	2-3 2-4 2-5
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	23	0.62 0.62 0.43	No No No	2-3 2-4 2-5
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	23	<0.071 <0.071 <0.071	No No No	2-3 2-4 2-5
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	23	0.91 0.71 0.94	Yes Yes Yes	2-3 2-4 2-5
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	23	0.07 0.07 0.06	No No No	2-3 2-4 2-5
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	23	<0.053 <0.053 <0.053	No No No	2-3 2-4 2-5

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.

Table 8c. Results of Phase I Monitoring, Third Floor.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	23	1.1 0.95 0.79	No No No	3-6 3-7 3-8
Benzene/0.1 (Benzol, Phenyl hydride)	23	1.8 1.1 1.3	Yes Yes Yes	3-6 3-7 3-8
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	23	0.06 0.06 0.07	Yes Yes Yes	3-6 3-7 3-8
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	23	0.08 0.07 0.04	Yes Yes Yes	3-6 3-7 3-8
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	23	0.112 0.085 <0.063	Yes Yes No	3-6 3-7 3-8
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	23	0.52 0.61 0.49	No No No	3-6 3-7 3-8
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	23	<0.071 <0.071 <0.071	No No No	3-6 3-7 3-8
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	23	1.0 0.83 0.93	Yes Yes Yes	3-6 3-7 3-8
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	23	0.08 0.07 0.06	No No No	3-6 3-7 3-8
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	23	<0.053 <0.053 <0.053	Yes Yes Yes	3-6 3-7 3-8

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.

Table 8d. Results of Phase I Monitoring, Blanks.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	24	ND[4]	No	Laboratory Blank
Benzene/0.1 (Benzol, Phenyl hydride)	24	ND	No	Laboratory Blank
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	24	ND	No	Laboratory Blank
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	24	ND	No	Laboratory Blank
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	24	<0.060 0.115 ND	No Yes No	0-0 (Equipment Blank) 0-1 (Trip Blank) Laboratory Blank
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	24	ND	No	Laboratory Blank
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	24	<0.068 <0.068 ND	No No No	0-0 (Equipment Blank) 0-1 (Trip Blank) Laboratory Blank
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	24	ND	No	Laboratory Blank
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	24	ND	No	Laboratory Blank
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	24	<0.051 <0.051 ND	No No No	0-0 (Equipment Blank) 0-1 (Trip Blank) Laboratory Blank

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.
[4]ND = Not Detected.

Kerosene. Total hydrocarbons were analyzed for the purposes of screening for the presence of volatile organics from kerosene. It was felt that this analysis would provide the best potential for detecting the broad family of volatile organic compounds in this mixture. The results are reported as hexane equivalent concentrations. This means that the instrument calibrations used hexane to define the quantitative detector response. Hydrocarbons were detected at 0.068 to 0.132 ppm on all three floors. The MDL for total hydrocarbons is reported as 0.063 ppm.

It should be noted in Table 8d that the trip blank sent to the vendor also was reported to contain 0.115 ppm total hydrocarbons. This has been discussed with the service laboratory and it is our opinion that the results on the various floors may represent laboratory contamination and may not be indicative of a general building-wide contamination.

Methylene Chloride. Methylene chloride was detected above MDL on the first floor only at 1.4 and 1.6 ppm. The MDL reported by the vendor is 1.0 ppm. Thus, the levels found on the first floor would appear to be significant.

Methyl-Isobutyl Ketone. The MIBK was not detected above the MDL of 0.071 ppm.

Toluene. Toluene was detected above MDL on the second and third floors at 0.71 to 1.0 ppm. The MDL reported by the vendor is 0.3 ppm. Thus, the levels would appear to be significant.

Trichloroethylene. Trichloroethylene was detected above the MDL at one sampling point (1-2) on the first floor. The result of 0.11 ppm is just slightly above the reported MDL.

Xylenes. Xylenes were not detected above the MDL of 0.053 ppm.

6.2.5 Conclusion

These sampling results were compared to the OSHA-permissible exposure limits (PEL) and only benzene was found to potentially exceed the 1-ppm OSHA PEL (see Table 9).

The results were also compared to the 40 Code of Federal Regulations (CFR) 302 (EPA 1989), reportable quantity (RQ) limits (see Table 9). This was done by taking the highest result detected by the sampling program and assuming all of the building exhaust was contaminated to that level. A value of 32,636 ft^3/min was used in the calculation. Again, only benzene was found to exceed the 40 CFR 302 RQ. The RQ for benzene is 10 lb/d; the projected output ranged from a low of 10.4 lb/d (at 1.1 ppm) to a high of 18 lb/d (at 1.9 ppm).

The distribution of benzene in the building was relatively uniform and suggests that either the intake air for the building may be picking up benzene from an unknown source, or there may be some as yet unknown interference in

Table 9. Summary of Results.

Target Compound	Highest Result (ppm)	Potentially Exceeds PEL	Potentially Exceeds RQ
Acetone	1.4	No	No
Benzene	1.9	Yes	Yes
Carbon Tetrachloride	0.15	No	No
Chloroform	0.23	No	No
Kerosene (total hydrocarbons)	0.132	No[1]	No[2]
Methylene Chloride	1.6	No	No
MIBK	0.071	No	No
Toluene	1.0	No	No
Trichloroethylene	0.11	No	No
Xylene	ND	No	No

[1]Based on 50 ppm limit for Hexane
[2]Compared to 100 lb/24 h RQ of 40 CFR 302 based on ignitability.

the analysis that is giving false positive results. In addition, it does not seem credible that a source of benzene exists of the magnitude required for emissions of this size.

A follow-up resample of the building and intake air will be performed immediately to confirm the initial benzene results.

6.3 PHASE II SAMPLING

The selected target compounds and the estimated detection limit are listed in Table 9. For compounds analyzed and reported in Phase I, the vendor reports listed a detection limit. For compounds to be analyzed in Phase II, this limit was calculated from vendor literature that related the length of time the sampler would have to be exposed to the target atmosphere to detect the time-weighted average-PEL. For example, if the monitor required 8 h to detect 240 ppm the estimated detection level for a 24-h exposure would be 240/3 = 80 ppm.

6.3.1 Methodology

Passive-adsorption-type air monitors were chosen for this task. The cartridges are loaded with a charcoal absorbent and separated from the air by a porous membrane. The passive monitors were obtained from Advanced Chemical Sensors Company of Pompano Beach, Florida and 3M Company of St. Paul, Minnesota. The organic vapor enters the monitor by diffusion and is adsorbed onto the charcoal adsorbent. At the end of the sampling period, the monitor is sealed in a bag or can to terminate sampling, and returned to the laboratory for measurement.

At the laboratory, the adsorbed organic chemical is generally desorbed into a solvent suitable for gas chromatographic analysis and subsequently analyzed to obtain the weight of organic chemical adsorbed. Benzene was analyzed by infrared spectrometry. Application of known diffusion/adsorption rates allows calculation of a time-weighted concentration average in the air sampled.

6.3.2 Sampling Placement

The TRUSAF sampling points chosen are indicated in Figures 6, 7, and 8 and described in Table 10. The sample location numbering system is the same as for Phase I. The samples were collected and identified in the same manner as in Phase I.

6.3.3 Quality Assurance/Quality Control

The quality assurance/quality control arrangements for Phase II sampling were identical to those for Phase I.

Table 10. Description of Transuranic Waste Storage and Assay Facility Sampling Location.

Location	Description
1-1	On the north end of the 1st floor, approximately 5 ft south of column C-1
1-2	On the south wall of the 1st floor, approximately 10 ft west of the scales
2-3	On the north end of the 2nd floor by column B-2, approximately 10 ft from the east wall
2-4	On the east side of the 2nd floor between columns B-5 and B-6, approximately 8 ft from the east wall
2-5	On the south end of the 2nd floor in the corner by column B-8, approximately 5 ft from the south wall and 8 ft from the east wall
3-6	On the north end of the 3rd floor near column B-2, approximately 3 ft from the east wall
3-7	On the east side of the 3rd floor near column B-4 on an unused CAM stand about 1 ft from the east wall
3-8	On the south end of the 3rd floor near column B-6, approximately 11 ft from the south wall and 11 ft from the east wall
A-BI	Immediately to the south of the TRUSAF building air intake at the 5-6 ft level. Exterior air sample.
P-1	Approximately 10 miles southwest of the Hanford Site, inside a small outbuilding.

6.3.4 Results

The results of the Phase II air monitoring task are presented in Tables 11a through 11d. Each table lists the target compounds and selected synonyms, sampling time, results, and sampling locations for one floor. The sampling and analysis results will be discussed by compound.

Acetone. Acetone was not detected above the MDL of 7 ppm.

Benzene. Initially, benzene was found on all three floors between 1.1 and 1.9 ppm. The detection level for benzene via this method is reported as 0.1 ppm. Discussions with the analyst at the service laboratory revealed that the batch blank run at the laboratory did not show any contamination that would indicate contamination of the adsorbent lot that the monitors came from. The analyst noted the presence of significant adsorbed water vapor on the monitors, but did not think it would have significantly affected the infrared measurement of desorbed benzene.

The distribution of benzene in the building appeared relatively uniform and suggested that either the intake air for the building may be picking up benzene from an unknown source, or there may have been some as yet unknown interference in the analysis that was giving false positive results. In addition, it did not seem credible that a source of benzene exists at TRUSAF of the magnitude required for emissions of this size.

A follow-up resample of the building and air intake was performed immediately to determine if the first sampling was incorrect or would be confirmed. In addition to the eight positions originally sampled inside TRUSAF, two sampling locations and trip blank were run. One new location was the building air intake at ground level on the west side of the building (see Figure 6 and Table 7). This location was chosen to determine if an exterior source of benzene could be detected. Another new location was an offsite building chosen to provide an operational blank subject to similar temperature and humidity conditions as the samples onsite.

The results of the follow-up monitoring did not confirm the presence of benzene in TRUSAF at the levels indicated by the first sampling. Although traces of benzene slightly above the 0.1 ppm detection limit were reported in a couple of locations with TRUSAF, similar trace levels were found in the trip blank (B-2) and the offsite building (P-1); thus, they are not considered significant.

The different results from the two sampling efforts could be a result of any of the following:

- Laboratory contamination of the samplers
- An unknown compound giving a false positive result
- A transient contamination of the inside building air
- Transient source term outside the building.

Table 11a. Results of Phase II Monitoring, First Floor.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	23	0.64 0.95	No No	1-1 1-2
Benzene/0.1 (Benzol, Phenyl hydride)	23	0.15 <0.10 <0.10	Yes No No	1-1 1-2 A-BI
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	23	0.15 0.06	Yes Yes	1-1 1-2
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	23	0.23 0.14	Yes Yes	1-1 1-2
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	23	0.132 0.116	Yes Yes	1-1 1-2
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	23	1.6 1.4	Yes Yes	1-1 1-2
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	23	<0.071 <0.071	No No	1-1 1-2
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	23	0.15 0.06	No No	1-1 1-2
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	23	0.07 0.11	No Yes	1-1 1-2
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	23	<0.053 <0.053	No No	1-1 1-2

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.

Table 11b. Results of Phase II Monitoring, Second Floor.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result[3] (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	23	0.4 1.1 1.0	No No No	2-3 2-4 2-5
Benzene/0.1 (Benzol, Phenyl hydride)	23	<0.10 0.11 <0.10	No Yes No	2-3 2-4 2-5
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	23	0.06 0.07 0.04	Yes Yes Yes	2-3 2-4 2-5
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	23	0.14 0.07 0.08	Yes Yes Yes	2-3 2-4 2-5
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	23	<0.063 0.094 0.068	No Yes Yes	2-3 2-4 2-5
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	23	0.62 0.62 0.43	No No No	2-3 2-4 2-5
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	23	<0.071 <0.071 <0.071	No No No	2-3 2-4 2-5
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	23	0.91 0.71 0.94	Yes Yes Yes	2-3 2-4 2-5
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	23	0.07 0.07 0.06	No No No	2-3 2-4 2-5
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	23	<0.053 <0.053 <0.053	No No No	2-3 2-4 2-5

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.

Table 11c. Results of Phase II Monitoring, Third Floor.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	23	1.1 0.95 0.79	No No No	3-6 3-7 3-8
Benzene/0.1 (Benzol, Phenyl hydride)	23	<0.10 <0.10 <0.10	No No No	3-6 3-7 3-8
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	23	0.06 0.06 0.07	Yes Yes Yes	3-6 3-7 3-8
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	23	0.08 0.07 0.04	Yes Yes Yes	3-6 3-7 3-8
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	23	0.112 0.085 <0.063	Yes Yes No	3-6 3-7 3-8
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	23	0.52 0.61 0.49	No No No	3-6 3-7 3-8
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	23	<0.071 <0.071 <0.071	No No No	3-6 3-7 3-8
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	23	1.0 0.83 0.93	Yes Yes Yes	3-6 3-7 3-8
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	23	0.08 0.07 0.06	No No No	3-6 3-7 3-8
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	23	<0.053 <0.053 <0.053	Yes Yes Yes	3-6 3-7 3-8

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.

Table 11d. Results of Phase II Monitoring, Blanks.

Target Compounds/MDL (ppm)[1] and Common Synonyms	Sampling Time (h)[2]	Result (ppm)[3]	Detected? (>MDL)	Sampling Location (Floor-Location #)
Acetone/7 (Diemthyl Ketone, Ketone propane, 2-propanone)	24	ND[4]	No	Laboratory Blank
Benzene/0.1 (Benzol, Phenyl hydride)	24	ND 0.11 0.10	No Yes No	Laboratory Blank B-2 Trip Blank P-1 Offsite Blank
Carbon Tetrachloride/0.02 (CCl_4, Perchloromethane, Freon 10, Halon 104, Tetrachloromethane)	24	ND	No	Laboratory Blank
Chloroform/0.02 ($CHCl_3$, Methane Trichloride, Trichloromethane)	24	ND	No	Laboratory Blank
Kerosene/0.064 (NPH, normal paraffin hydrocarbons) Total hydrocarbons measured	24	<0.060 0.115 ND	No Yes No	0-0 (Equipment Blank) 0-1 (Trip Blank) Laboratory Blank
Methylene Chloride/1.0 (Dichloromethane, Methylene Dichloride)	24	ND	No	Laboratory Blank
MIBK/0.071 (Methyl-isobutyl ketone, hexone, 4-methyl 2-pentanone)	24	<0.068 <0.068 ND	No No No	0-0 (Equipment Blank) 0-1 (Trip Blank) Laboratory Blank
Toluene/0.3 (Methyl Benzene, Toluol, Methyl Benzol, Phenyl Methane)	24	ND	No	Laboratory Blank
Trichloroethylene/0.1 (Ethylene Trichloride, Triclene, Trichloroethene)	24	ND	No	Laboratory Blank
Xylenes/0.053 (o,m, or p-Xylol; 1,2; 1,3; or 1,4-dimethyl benzene)	24	<0.051 <0.051 ND	No No No	0-0 (Equipment Blank) 0-1 (Trip Blank) Laboratory Blank

[1]MDL based on vendor estimate of lowest concentration that can be detected at an overall accuracy of ±25% at the 95% confidence level.
[2]Rounded to the nearest 5 min.
[3]Results as reported by vendor.
[4]ND = Not Detected.

The time period of the initial sampling (June 5, 1991 to June 6, 1991) was marked by rain and high humidity (70% to 90%). In contrast, the second sampling for benzene (June 18, 1991 to June 19, 1991) was not marked by any noticeable rain and the relative humidity ranged from 24% to 35%. It is not expected that these different conditions would affect the results, but their effect cannot be categorically ruled out or quantified.

A diesel spill occurred near the building intake in December of 1990. Any traces of benzene present in the diesel fuel would have been expected to have volatized before the initial sampling effort, so contribution from this source would be unlikely.

Carbon Tetrachloride. Carbon tetrachloride was detected on all three floors between 0.04 and 0.15 ppm. The MDL for carbon tetrachloride via this method is reported as 0.02 ppm. Thus, although the levels are very low, they would appear to be significant.

Chloroform. Chloroform was detected on all three floors at 0.04 to 0.23 ppm. The MDL for chloroform via this method is reported by the vendor as 0.02 ppm. Thus, although the levels are very low, they would appear to be significant.

Kerosene. Total hydrocarbons were analyzed to screen for the presence of volatile organics from kerosene. It was felt that this analysis would provide the best potential for detecting the broad family of volatile organic compounds in this mixture. The results are reported as hexane equivalent concentrations. This means that the instrument calibrations used hexane to define the quantitative detector response. Hydrocarbons were detected at 0.068 to 0.132 ppm on all three floors. The MDL for total hydrocarbons is reported by the vendor as 0.063 ppm.

It should be noted in Table 11d that the trip blank sent to the vendor also was reported to contain 0.115 ppm total hydrocarbons. This has been discussed with the service laboratory and it appears that the results on the various floors may represent laboratory contamination and may not be indicative of a general building-wide contamination.

Methylene Chloride. Methylene chloride was detected above the MDL on the first floor only at 1.4 and 1.6 ppm. The MDL reported by the vendor is 1.0 ppm. Thus, the levels found on the first floor would appear to be significant.

Methyl-Isobutyl Ketone. The MIBK was not detected above the MDL of 0.071 ppm.

Toluene. Toluene was detected above MDL on the second and third floors at 0.71 to 1.0 ppm. The MDL reported by the vendor is 0.3 ppm. Thus, the levels would appear to be significant.

Trichloroethylene. Trichloroethylene was detected above the MDL at one sampling point (1-2) on the first floor. The result of 0.11 ppm is slightly above the reported MDL of 0.10 ppm.

Xylenes. Xylenes were not detected above the MDL of 0.053 ppm.

6.3.5 Conclusion

These sampling results were compared to the OSHA PEL (see Table 12). No organic compounds were found to potentially exceed the OSHA PEL.

The results were also compared to the EPA's 40 CFR 302, RQ limits (see Table 4). This was done by taking the highest confirmed result detected by the sampling program and assuming all of the building exhaust was contaminated to that level. A value of 32,636 ft^3/min was used in the calculation. No compounds were found to exceed the 40 CFR 302 RQ.

The results of the Phase II Air Sampling Task are provided in Attachment 2.

Table 12. Summary of Results.

Target Compound	Highest Result (ppm)	Potentially Exceeds PEL	Potentially Exceeds RQ
Acetone	1.4	No	No
Benzene	0.15	No	No
Carbon Tetrachloride	0.15	No	No
Chloroform	0.23	No	No
Kerosene (total hydrocarbons)	0.132	No[1]	No[2]
Methylene Chloride	1.6	No	No
MIBK	0.071	No	No
Toluene	1.0	No	No
Trichloroethylene	0.11	No	No
Xylene	ND	No	No

[1]Based on 50 ppm limit for hexane
[2]Compared to 100 lb/24 h RQ of 40 CFR 302 based on ignitability.

7.0 SUMMARY

Based on the information initially collected and the data reviewed, the FEMP determination for the TRUSAF indicated that a FEMP would be required. This determination considered radioactive and hazardous materials present during routine and upset operating conditions and the potential releases for airborne and liquid effluent pathways. It was recommended that a FEMP be prepared based on the data for the radioactive and hazardous airborne effluent release pathways and the hazardous liquid release pathways.

No routine operations are conducted at TRUSAF that are expected to produce radioactive or nonradioactive effluents. The credible upset conditions considered for this report, which include loss of HVAC, loss of HEPA filtration, dropping of a drum, and activation of the fire suppression system do not result in consequences requiring a FEMP.

Further investigation of the sealed portion of the building has determined that it will have no affect on facility effluents for either routine operations or upset conditions. The only routine facility effluent that originates in the sealed portion of the building is the ventilation air flow. If it is assumed that all airborne effluents collected by the record samplers come from the sealed portion of the building, the resulting dose consequences do not require a FEMP. The sealed portion of the building has limited potential for upset conditions. Although the process cells contain surface contamination, much of it is fixed and there are no credible upset conditions that would transport it to the environment. The TRUSAF has no sources of water that would create the potential for flooding. If water were to enter the cell portion of the building, the drain system would route the water to the C cell sump where it would be contained. If an old process tank containing residual liquid contaminants leaked, the resulting spill would also be directed via the drains to the C cell sump. Flooding or a spill beyond an upset condition would be required to overflow the C cell sump. Any airborne contamination created by flooding or a tank leak would be removed by the ventilation and filtration system. There are no routine or upset conditions associated with the sealed portion of the building that would result in an airborne or liquid release to the environment greater than the limits requiring a FEMP.

With the removal of the emergency steam plant, no nonradioactive hazardous materials are in routine use at the TRUSAF. However, it is known that the TRU containers can contain hazardous waste if it coexists with the TRU waste. The waste containers are vented and the vents are fitted with either a charcoal or HEPA filter. Based on the solid waste acceptance criteria it is unlikely that the amount of volatile hazardous material released from the containers would exceed the limit necessitating a FEMP. However, no sample data currently exists to document that the venting of the containers does not contribute a significant amount of hazardous material to the TRUSAF airborne effluents.

Based on the characterization of all identified TRUSAF effluent streams and a review of the data currently available a FEMP is not required for the TRUSAF. The only area of concern that cannot be currently verified with existing sample data is the airborne emission of nonradioactive hazardous material. Therefore, it is recommended that sampling for nonradioactive hazardous materials be instituted on a periodic basis to document and verify that TRUSAF emissions of nonradiological hazardous materials are below the level of concern. The Phase II Air Sampling Task results, which are found in Attachment 2, support these conclusions.

8.0 REFERENCES

ANSI, 1969, *Guide to Sampling Airborne Radioactive Materials in a Nuclear Facility*, ANSI N13.1, American National Standards Institute, Washington, D.C.

EPA, 1982, *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods*, SW 846 Revision 0, Second Edition, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989, "Designation, Reportable Quantities, and Notification," Title 40, Code of Federal Regulations, Part 302, U.S. Environmental Protection Agency, Washington, D.C.

WAC, 1989, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington.

WHC, 1991a, *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans*, WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington

WHC, 1991b, *Quality Assurance Project Plan for Facility Effluent Monitoring Plan Activities*, WHC-EP-0446, Westinghouse Hanford Company, Richland, Washington.

Willis, N. P., 1990, *Hanford Site Radioactive Solid Waste Acceptance Criteria*, WHC-EP-0063-2, Westinghouse Hanford Company, Richland, Washington.

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENTS

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY TRUSAF

DISCHARGE POINT Main Building Stacks (Stacks 286-T-11 & 12)

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/ Chemical Form	Quantity (Ci)	Quantity Released (Ci)	Projected Dose (mrem)
1.	TRU	Particulate	Not Avail.	0	0
2.	Unknown	Not Avail.	Not Avail.	Not Avail.	Unknown
Total					

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated Material	Quantity (lb)	Quantity Released	Reportable Quantity (lb)	% of Reportable Quantity/Yr
1.	Potassium Hydroxide	1	Not Avail.	1,000	<1

Identification of Reference Material

Draft SAR for TRUSAF, SD-WM-SAR-025 Rev. 0, Pg. 5.

Hanford Site Radioactive Solid Waste Acceptance Criteria, Willis, N.P., Westinghouse Hanford Company, Richland, Wa. September 1990, Pg. 3-6

Draft SAR for TRUSAF, SD-WM-SAR-025 Rev. 0, Pg. 64.

Listing of Locations Which Have Chemicals Stored as of 3/1/90.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required _____

EVALUATOR [signature] * Date DATE 5/8/91

MANAGER, ENVIRONMENTAL [signature] Date DATE 5/20/91

FACILITY MANAGER [signature] Date DATE 5/13/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY TRUSAF DISCHARGE POINT Fuel Tanks

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/ Chemical Form	Quantity (Curies)	Quantity Released	Projected Dose (mrem)
1.					
2.					
Total					

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated Material	Quantity (lbs)	Quantity Released	Reportable Quantity (lbs)	% of Reportable Quantity/Yr
1.	Benzene	Not Avail.	0	>0*	Not Defined

*Washington State Department of Ecology, Dangerous Waste Regulations do not specify a de minimus quantity for reporting purposes (WAC 173-303-145).

Identification of Reference Material.

Listing of Locations Which Have Chemicals Stored as of 3/1/90.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100 % of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required _____

EVALUATOR [signature] * DATE 5/8/91

MANAGER, ENVIRONMENTAL [signature] DATE 5/20/91

FACILITY MANAGER [signature] DATE 5/13/91

Science Applications International Corporation
An Employee-Owned Company

May 28, 1991 91-0138.AVR

Mr. Robert E. Bolls
Restoration and Upgrades Programs
Westinghouse Hanford Company
P. O. Box 1970 MSIN N3-13
Richland, WA 99352

SUBJECT: ORGANIC MONITORING FOR TRUSAF

Dear Bob:

We have attempted to prioritize the monitoring effort in order to accomplish as much as possible within the time and funding constraints of Phase 1. Table 1 summarizes the list of compounds that we currently feel should be evaluated in Phase 1 and Phase 2, based on the documents provided, discussions with you, and discussions with other SAIC staff.

As a result of our visit to the facility on 5-24-91 and review of the documents provided, we believe that Phase 1 screening should consist of two locations on the first floor, three locations on the second floor, and three locations on the third floor. All floors will be monitored for the 10 organics indicated in Table 1 under "Study Phase 1."

Based on the results of Phase 1 sampling, Phase 2 sampling may need to be significantly modified.

We are proceeding immediately with the placement of an order for passive monitors in order to comply with the ambitious schedule proposed in the addition to the Statement of Work for Task Order 91-14.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Al Robinson
Senior Scientist

drs

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Science Applications International Corporation
An Employee-Owned Company

June 28, 1991 91-0188.AVR

Mr. Robert E. Bolls
Restoration and Upgrades Programs
Westinghouse Hanford Company
P. O. Box 1970
MSIN N3-13
Richland, WA 99352

REFERENCE: PURCHASE ORDER CONTRACT MLW-SVV-518974, TASK 91-14

SUBJECT: UPDATE TO LETTER REPORT FOR THE TRUSAF PHASE I AIR SAMPLING TASK

Dear Bob:

Task Order 91-14 was issued to SAIC in February 1991 for the preparation of a Facility Effluent Monitoring Plan (FEMP) Report for the TRUSAF Facility. However, initial data gathered indicated that a full scale FEMP report may not be required. To verify this finding, it was recommended in the Summary and Conclusion section of the TRUSAF Draft FEMP Report that air emission samples be taken at the facility. Therefore, the purpose of this air sampling task was to determine the presence or absence of organic air emissions. A two-phase sampling approach was proposed. This letter report provides a discussion of the technical approach and results from Phase I as reported June 14, and an update on confirmatory monitoring for benzene.

Selection of Target Compounds

Target compounds were selected based on various sources including:

- Discussions with WHC staff
- Discussions with Senior SAIC staff
- Review of WHC Internal Memo ("WRAP Support and Waste Characterization" to W. W. Olson, dated February 8, 1991)
- Hanford Site Radioactive Solid Waste Acceptance Criteria, 1990, WHC-EP-0063-2.

Phase II Sampling

The selected target compounds are listed in Table 1. Also indicated in Table 1 is the estimated detection limit. For compounds analyzed and reported in Phase I, the vendor reports listed a detection limit. For compounds to be analyzed in Phase II, this limit was calculated from vendor literature which related the length of time the sampler would have to

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be exposed to the target atmosphere to detect the time weighted average permissible exposure limit (TWA-PEL). As an example, if the monitor required 8 hours to detect 240 ppm, then the estimated detection level for a 24-hour exposure would be 240/3 = 80 ppm.

6.3.1 Methodology

The air monitors chosen for this task were a passive adsorption-type. The cartridges are loaded with a charcoal absorbent and separated from the air by a porous membrane. The passive monitors were obtained from two vendors, Advanced Chemical Sensors Co. of Pompano Beach, FL and 3M Company of St. Paul, MN. The organic vapor enters the monitor by diffusion and is adsorbed onto the charcoal adsorbent. At the end of the sampling period, the monitor is sealed in a bag or can to terminate sampling, and returned to the laboratory for measurement.

At the laboratory, the adsorbed organic chemical is generally desorbed into a solvent suitable for gas chromatographic (G.C.) analysis and subsequently analyzed to obtain the weight of organic chemical adsorbed. Benzene was analyzed by infrared spectrometry. Application of known diffusion/adsorption rates allows calculation of a time-weighted concentration average in the air sampled.

6.3.2 Sampling Placement

The placement of the air monitors was based on a review of a letter report from G. A. Stoetzel to M. A. Ortega (September 21, 1989) and a site visit by A. V. Robinson, G. F. Martin, and M. P. Moeller. The TRUSAF sampling points chosen are indicated on the accompanying maps (Figures 1, 2, and 3) and described in Table 2. The sample location numbering system consisted of two numbers separated by a hyphen. The first of the two numbers reflects the floor being sampled (1, 2, or 3), the second number is a sequential number designating the individual sampling location. The monitors were hung on wire racks at approximately 5-6 ft. height. An additional offsite sampling point was tested for benzene to provide an additional control value.

The date, time, location, monitor I.D., target compounds, and comments were recorded on a Data Log (Figure 4) at the time of monitor placement. The date and time sampling was terminated was recorded on the Data Log when the samplers were picked up approximately 23 hours later. All monitors were surveyed for unconditional release by a WHC Radiation Monitoring Technician prior to removal from the facility.

Mr. Robert E. Bolls
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June 28, 1991

91-0174.AVR

6.3.3 Quality Assurance / Quality Control

QA/QC

The quality assurance / quality control arrangements for Phase II sampling were identical to those for phase I.

~~A blank and calibration standard are run with each analytical batch in the laboratory and~~ estimates of precision and accuracy are supplied by the Organic Vapor Monitor Vendors. A trip blank and an equipment blank were also prepared for selected organics (xylene, MIBK, total hydrocarbons) and the resampling confirmatory measurements on benzene. The analysis blank, calibration standards, trip blank, and equipment blank are similar to QC reference samples as defined in WHC-EP-0446 (WHC 1991b) and EPA's SW-846 (EPA 1982). Analysis results are evaluated with regard to the overall system accuracy. Vendors comply with OSHA requirements of ±25% overall system accuracy with 95% confidence limits.

6.3.4 Results

The results of the Phase II air monitoring task are presented in Table 9a-9d. Each table lists the target compounds and selected synonyms, sampling time, results, and sampling locations for one floor. The sampling and analysis results will be discussed by compound.

Acetone

Acetone was not detected above the MDL of 7 ppm.

Benzene

Initially, benzene was found on all three floors between 1.1 and 1.9 ppm. The detection level for benzene via this method is reported as 0.1 ppm. Discussions with the analyst at the service laboratory revealed that the batch blank run at the laboratory did not show any contamination that would indicate contamination of the adsorbent lot that the monitors came from. The presence of significant adsorbed water vapor on the monitors was noted by the analyst but he did not ~~feel as though~~ it would have significantly affected his infrared measurement of desorbed benzene.

The distribution of benzene in the building appeared relatively uniform and suggested that either the intake air for the building may be picking up benzene from an unknown source, or there may have been some as yet unknown interference in the analysis that was giving false positive results. In addition, it did not seem credible that a source of benzene exists at TRUSAF of the magnitude required for emissions of this size.

A follow-up re-sample of the building and intake air was performed immediately to determine if the first sampling was incorrect or would be confirmed. In addition to the 8 positions originally sampled inside TRUSAF, two additional sampling locations and an

additional trip blank were run. One new location was the building air intake at ground level on the west side of the building (see Figure 1 & Table 2). This location was chosen to determine if an exterior source of benzene could be detected. Another new location was an offsite building chosen to provide an operational blank subject to similar temperature and humidity conditions as the samples onsite.

The results of the followup monitoring did not confirm the presence of benzene in TRUSAF at the levels indicated by the first sampling. Although traces of benzene slightly above the 0.1 ppm detection limit were reported in a couple of locations within TRUSAF, similar trace levels were found in the trip blank (B-2) and the offsite building (P-1), thus they are not considered significant.

The different results from the two sampling efforts could be a result of: many of the following

- ~~a)~~ laboratory contamination of the samplers,
- ~~b)~~ an unknown compound giving a false positive result,
- ~~c)~~ a transient contamination of the inside building air, ~~or~~
- ~~d)~~ transient source term outside the building.

The time period of the initial sampling (6/5/91 - 6/6/91) was marked by rain and high humidity (70-90%). In contrast the second sampling for benzene (6/18/91 - 6/19/91) was not marked by any noticeable rain and the relative humidity ranged from 24-35%. It is not expected that these different conditions would affect the results, but their effect cannot be categorically ruled out or quantified.

~~It is known that~~ a diesel spill occurred near the building intake in December of 1990.[1] Any traces of benzene present in the diesel would have been expected to have volatilized ~~prior to~~ before the initial sampling effort, so contribution from this source would be unlikely.

Carbon Tetrachloride

Carbon tetrachloride was detected on all three floors between 0.04 and 0.15 ppm. The MDL for carbon tetrachloride via this method is reported as 0.02 ppm Thus, although the levels are very low, they would appear to be significant.

[1] Draft Transuranic Waste Storage and Assay Facility Effluent Monitoring Plan Letter Report. Contract Number MLW-SVV-518974, Task Number 91-14, 4/30/91.

Chloroform

Chloroform was detected on all three floors at 0.04 to 0.23 ppm. The MDL for chloroform via this method is reported by the vendor as 0.02 ppm. Thus, although the levels are very low, they would appear to be significant.

Kerosene

Total hydrocarbons were analyzed ~~for the purposes of~~ to screening for the presence of volatile organics from Kerosene. It was felt that this analysis would provide the best potential for detecting the broad family of volatile organic compounds in this mixture. The results are reported as hexane equivalent concentrations. This means that the instrument calibrations used hexane to define the quantitative detector response. Hydrocarbons were detected at 0.068 to 0.132 ppm on all three floors. The MDL for total hydrocarbons is reported by the vendor as 0.063 ppm.

It should be noted in Table 3d that the trip blank sent to the vendor also was reported to contain 0.115 ppm total hydrocarbons. This has been discussed with the service laboratory and it is our opinion that the results on the various floors may represent laboratory contamination and may not be indicative of a general building-wide contamination.

Methylene Chloride

Methylene chloride was detected above the MDL on the first floor only at 1.4 and 1.6 ppm. The MDL reported by the vendor is 1.0 ppm. Thus, the levels found on the first floor would appear to be significant.

MIBK

MIBK was not detected above the MDL of 0.071 ppm.

Toluene

Toluene was detected above MDL on the second and third floors at 0.71 to 1.0 ppm. The MDL reported by the vendor is 0.3 ppm. Thus, the levels would appear to be significant.

Trichloroethylene

Trichloroethylene was detected above the MDL at one sampling point (1-2) on the first floor. The result of 0.11 ppm is just slightly above the reported MDL of 0.10 ppm.

Xylenes

Xylenes were not detected above the MDL of 0.053 ppm.

4.3.3 Conclusion

The sampling results discussed above were compared to the OSHA ~~permissible exposure limits~~ (PELs) [see Table 18]. No organic compounds were found to potentially exceed the OSHA PEL .

The results were also compared to the EPA's 40 CFR 302, reportable quantity (RQ) limits (see Table 4). This was done by taking the highest confirmed result detected by the sampling program and assuming all of the building exhaust was contaminated to that level. A value of 32,636 ft^3/min was used in the calculation. No compounds were found to exceed the 40 CFR 302 RQ.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Al Robinson
Senior Scientist

drs

Attachments

cc: G. Martin - SAIC
R. Pierce - WHC
B. Olson - WHC
A. Robinson - SAIC
M. Roy - SAIC
File/LB

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ATTACHMENT 2

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENTS

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Science Applications International Corporation
An Employee-Owned Company

August 30, 1991 91-0258.AVR

Mr. Robert E. Bolls
Restoration and Upgrades Programs
Westinghouse Hanford Company
P. O. Box 1970
MSIN N3-13
Richland, WA 99352

REFERENCE: PURCHASE ORDER CONTRACT MLW-SVV-518974, TASK 91-14

SUBJECT: LETTER REPORT FOR THE TRUSAF PHASE II AIR SAMPLING TASK

Dear Bob:

Task Order 91-14 was issued to SAIC in February 1991 for the preparation of a Facility Effluent Monitoring Plan (FEMP) Report for the TRUSAF Facility. However, initial data gathered indicated that a full scale FEMP report may not be required. To verify this finding, it was recommended in the Summary and Conclusion section of the TRUSAF Draft FEMP Report that air emission samples be taken at the facility. Therefore, the purpose of this air sampling task was to determine the presence or absence of mercury and organic air emissions. A two-phase sampling approach was proposed. This letter report provides a discussion of the technical approach and results from Phase II.

1.0 PHASE II ORGANIC MONITORING

The purpose of the Phase II study of the Organic Vapor Monitoring task was to assess the potential of barrels stored at TRUSAF to emit volatile organic compounds, mercury, and flammable gases such as hydrogen and methane. A range of barrels were chosen to represent the span of ages of the waste at TRUSAF as well as the plutonium content. Additional considerations involved maximizing the potential of detecting the compounds of interest and thus allowing worst-case scenarios to be postulated with regard to total emissions from the TRUSAF facility and their potential impact on Facility Effluent Monitoring Plans (FEMPs). Table 1 lists the barrels chosen for analysis.

In order to trap the potential volatile compounds being emitted from the barrels, a 2 mil TEDLAR® bag measuring 24 x 40 in. was fabricated with two gas sampling ports. One of the ports was fitted with a septum and the other with an on/off valve which terminated in a 3/16-in hose barb.

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Table 1 TRUSAF Barrels Chosen for Phase II Sampling

Co. Bldg.	Rec. Date	Shipment	Container ID	Pu(g)	Comments [1,2]
1. WHC 2345-Z	8/21/86	860078	A14967	158	
2. WHC 2345-Z	1/21/87	870001	A15841	185	
3. WHC 2345-Z	6/9/89	890428	212-A18445	12	CCl_4, TBP
4. WHC 2345-Z	6/9/89	890429	212-A18446	3	CCl_4, TBP
5. WHC 2345-Z	7/25/89	890499	212-A18496	0.02	CCl_4, TBP
6. WHC 2345-Z	4/23/90	900039	212-A20499	33	Hg
7. WHC 2345-Z	4/23/90	900040	212-A20576	21	Hg
8. WHC 2345-Z	10/23/90	900320	220-A20277	141	
9. WHC 2345-Z	7/25/91	910232	212-A2110	7.0	Hg
10. WHC 2345-Z	7/25/91	910234	213-A21899	24	Hg

[1] Notations below relate to comments found on WHC inventory of barrel contents.
[2] CCl_4 = carbon tetrachloride, TBP = tributyl phosphate, Hg = mercury

These bags were transported to the site, slit open along one 40-in seam, and taped around the barrel to create a headspace above the barrel (see Figure 1). Each bag was evacuate with an air pump and then refilled with 10ℓ of room air. A control bag was also filled with room air and left on site as an additional control; it is designated as a process control.

The barrels were then allowed to equilibrate for 6 days, at which time the headspace air was measured directly for mercury, % LEL, O_2, and organic vapors. The details of the measurements are discussed below.

2.0 METHODOLOGY

As discussed above, the purpose of the study was to characterize gaseous emissions from the selected barrels. The general categories selected were:

2.1 Flammability (lower explosive limit or LEL)

This category would measure any explosive gas or vapor in the atmosphere retained above the barrels. These gases or vapors could include H_2, CH_4, Acetone, Benzene, Hexane, Toluene, Xylene, or any other flammable gas.

The instrument chosen for these measurements was a Bacharach 302 Sniffer that measures both % of LEL and % O_2. The instrument utilizes a platinum bead catatylic sensor for detection of combustibles and an electrochemical cell oxygen detector.

The instrument was calibrated against a methane standard (1.5% CH_4, 30% LEL) prior to use and following use. The methane standard was certified to ± 2% LEL. The instrument was also checked against a hydrogen (H_2) standard prepared by SAIC. The response was within the range predicted by the manufacturer's response curves.

Measurements were taken by attaching the Bacharach 302 probe to the tubing valve in the bag. Readings were then taken from the bag to determine % O_2 and % LEL. The range of the instrument was from 0-100% LEL and 0-25% O_2.

2.2 Mercury Vapor

Analysis for mercury vapor was performed using a Jerome 411 Mercury Vapor Analyzer. The analyzer detector is a thin, gold film which registers a change in electrical resistance proportional to the mass of mercury in the sample. The gold film is selective in its adsorption of elemental mercury and thus does respond to water vapor or organic solvents.

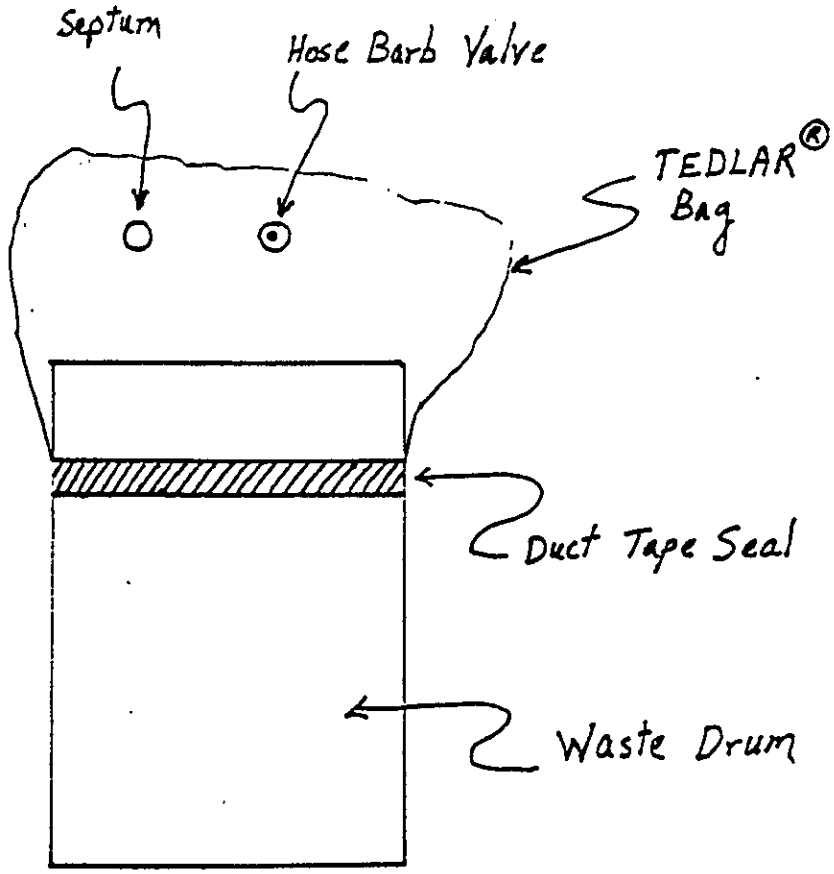

Figure 1 Barrel Bagging Procedure

The instrument has an attached probe that is about 6 in. long and 1/4 in. O.D. A 14-gauge needle was attached to the probe via a very short (~1 in.) length of vinyl tubing. Access to the bag atmosphere was obtained by piercing the septum fitting on the bag. A 10-second sampling mode was activated which resulted in about 80 mℓ of air being drawn from the bag. The readings were continued until a repeatable reading was obtained.

The manufacturer claims a detection level of 0.003 mg/m^3, a precision of 5% RSD, and an accuracy of ±5% at 0.107 mg/m^3 Hg.

2.3 Organic Vapor Monitoring

A Thermo/Electron Model 580A Organic Vapor meter with a 11.7 eV photoionization lamp was used to monitor the total organics in the trapped air. The 11.7 eV lamp was chosen because it would allow detection of a broad array of compounds including all of the volatile organic compounds previously identified in Phase I, Table 1.

The principle of operation is that organic compounds in air pass through a detector with a 11.7 eV ultraviolet lamp. A fraction of the organic molecules are ionized and the resulting current is measured.

The OVM 580A was calibrated against a 75 ppm (±2%) standard gas (isobutylene in air). The response of the OVM was also measured against three other standards in order to assess the variable response of the instrument over a span of ionization potentials. The compounds chosen were carbon tetrachloride (CCl_4, I.P. = 11.47 eV), benzene (I.P. = 9.24) and xylene (X, I.P. = 8.45 eV). The results of this effort (Table 2) was to show that carbon tetrachloride showed the lowest response and xylene the highest response (relative to isobutylene).

The OVM 580A has a probe attached that is approximately 6 in. long and has a ¼ in. O.D. This probe was fitted with a 14-gauge needle (attached via a short length of vinyl tubing). Access to the collected air to be sampled was obtained by piercing the septum fitting on the bag. The instrument pump then drew the air through the detector at about 500 mℓ/min. The digital readout was observed until a stable reading was obtained, at which time the reading was recorded.

2.4 Organic Compound Identification

Two instruments were used to attempt to identify various organic compounds that were detected via the Bacharach 302 Sniffer and the OVM 580A. These instruments were a Photovac 10S50 gas chromatograph (G.C.) and a Miran 1B infrared analyzer (I.R.).

Table 2

Organic Compound	I.P. (eV)	Response (%)[1]
Xylene	8.45	98.6
Benzene	9.24	74
Carbon Tetrachloride	11.47	47.3

[1] Instrument calibrated against isobutylene.

The Photovac G.C. is equipped with a 10.6 eV lamp and a 29-ft separation column that can be set to operate in an isothermal mode from 20°C through 50°C. The column chosen for this work was a CP-Sil 5™ CB. This column is a 0.53 mm I.D. wide bore capillary column with a chemically bounded 100% Dimethyl Polysiloxane coating. This is a non-polar phase suitable for separating a wide variety of compounds and was suitable for most of the compounds of interest in this study.

The Miran 1B is a portable infrared ambient air monitor for workplace air monitoring. The analyzer has a variable path length sample cell (up to 20.5 meters). The calibration procedures were performed according to the manufacturer's direction each day prior to use.

The instrument is designed to sample ambient air at 35 ℓ/min. The analysis of air samples for this project involved limited sample size; therefore, an adaption of the instrument's calibration setup was required. The instrument is configured such that a closed loop system with known volume can be used to introduce known calibration standards (100 mℓ maximum volume) into the instrument to calibrate or check calibration. The system was modified (Figure 2) to allow introduction of larger samples (up to 4ℓ) into the loop for subsequent identification of the compounds. The infrared analyzer was used to confirm the presence of CCl_4 and methane. These two gases were considered a very high probability of being present and neither are detectable on the current configuration of the Photovac 10S50 G.C. The I.R. had both of these gases in the instrument library. Thus, the required standards consisted of check standards in order to confirm the calibration of the I.R. The standards run are listed in Table 3. Standards were run on the G.C. to establish retention times and quantitation response, a list of the standards run and relative retention times (RRT) is shown in Table 4. Samples (~4ℓ) of the barrel headspace air were collected in 5ℓ (12" x 12") tedlar gas bags and transported to the G.C. and I.R. for analysis. Various dilutions of the gases were prepared and run on the G.C. and I.R.

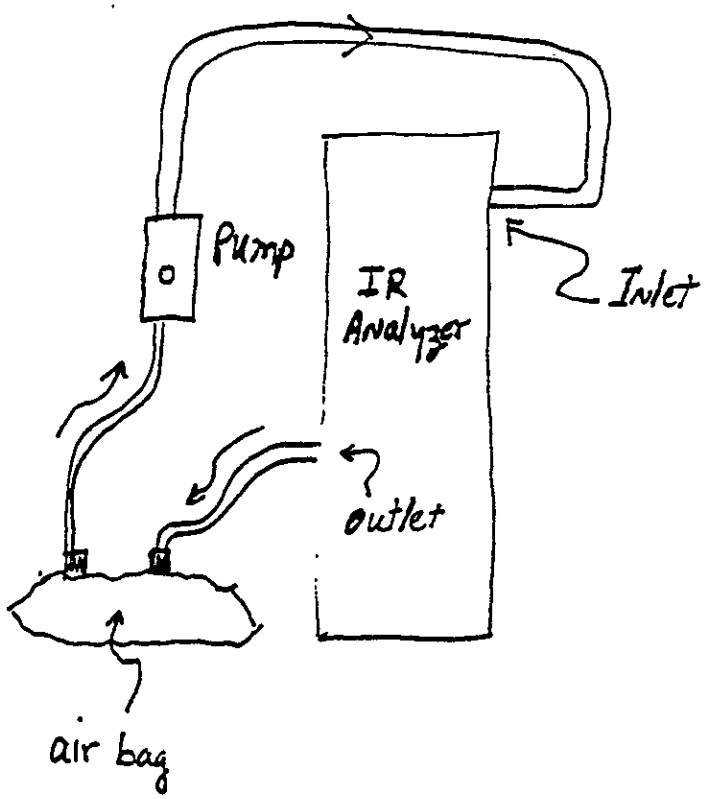

Figure 2 Calibration Loop Modification for Large Samples

Table 3 Check Standards Prepared for I.R. Analysis

Organic Chemical	Check Standard Concentration	Wavelength Analyzed	% of Expected
Carbon Tetrachloride	190,205 ppm	12.76 μm	71%, 76%
Methane	100 ppm	7.6 μm	42%, 47%

Table 4 Standards Prepared for G.C. Analysis

	Relative Retention Time (RRT)	
Organic Chemical	10mℓ/min	5 mℓ/min
Acetone	1	1
MEK	1.5	1.9
Hexane	3.2	2.2
Benzene	4.8	3.2
Trichloroethylene	—	4.4
MIBK	9.4	6.3
Toluene	7.5	8.1
Xylene	24.7	—

3.0 RESULTS

The results of the Phase II air monitoring task are presented in Tables 5 through 9. The results of each monitoring area will be discussed separately and a conclusion section will summarize the findings.

3.1 Flammability (% LEL)

The results of flammability testing with the Bacharach 302 Sniffer are tabulated in Table 5.

Table 5 Lower Explosive Limit (LEL)

Barrel	% LEL	% Oxygen	Positive H_2 (%)	ppm Methane by I.R.	Methane Calc % LEL[1]
1	5	19.3	>2	1085	2.2
2	7	17.8	>2	2507	4.6
3	3	19.4	>2	7696	15.4
4	0	19.9	1-2	838	1.6
5	4	19.5	0	30	<0.5
6	1	19.8	2	978	1.6
7	1	17.0	2	296	0.6
8	3	19.2	>2	789	1.6
9	1	19.1	2	513	1.0
10	1	19.9	2	395	0.8
11 (control)	0	20.4	0	0	0
Process Blank	0	20.4	---	0	0

[1] From I.R. analysis data

The barrel headspace did contain some flammable volatile compounds as evidenced by the % LEL. In addition, the barrels (particularly 2 and 7) revealed decreased levels of O_2. The barrel headspace was also tested for hydrogen (H_2) with a draeger tube type indicator. Although most of the barrels gave a positive indication, the presence of elevated levels of methane will also give false positive results, thus only negative H_2 results can be considered accurate. The I.R. results for methane and the % LEL calculated from the results were generally consistent with the % LEL measurement.

Two of the barrels (3 and 5) gave seemingly anomalous results. The methane levels in Barrel 3 should have produced a much higher LEL reading than measured. Barrel 3 may have been affected by the presence of very high levels (6091 ppm) of carbon tetrachloride (a non-flammable gas). Barrel 5 was negative for H_2 and $<0.5\%$ methane, yet it yielded a % LEL of 4%. A clue to this may be found in the organics identified for this barrel. The barrel contained a significant level of benzene and other short retention time gases. These gases may well have a % LEL of 1.5% (benzene) or less, thus for the reported level of organics (494-638 ppm), the LEL may be appropriate.

In any event, it can be concluded from these data that the 100% LEL required for an explosive mixture will not be exceeded.

3.2 Mercury Vapor

The results of the mercury monitoring are tabulated in Table 6. Only two barrels (B-5, B-6) gave confirmed positive results. Barrel B-6 was chosen because it contained mercury (noted on inventory). Barrels 7, 9, and 10 also contained mercury; however, no entrapped mercury vapor was found. Barrel 5 was not known to contain mercury but gave a positive reading.

The OSHA limit for elemental mercury in breathing air is 0.05 mg/m^3. The highest measured amount is 0.009 mg/m^3 or nearly 6 times less than that.

Table 6 Mercury Analysis Results

Barrel	Result (mg/m^3)
1	<0.003
2	<0.003
3	<0.003
4	<0.003
5	0.006
6	0.009
7	<0.003
8	<0.003
9	<0.003
10	<0.003
11 (control)	<0.003
Process Blank	<0.003

Assuming that all of the barrels in TRUSAF (~644) are emitting a level of mercury similar to Barrel 6 would allow calculation of the potential emission rate per 24 hours. The result of this calculation indicates that 2.1×10^{-5} lb/day would be emitted under these assumptions. This level is far below the reportable quantity of 1 lb/day found in 40 CFR 302. A FEMP is not required for this level of emission.

3.3 Organic Vapor Monitoring

The results of the organic vapor monitoring are presented in Table 7. The initial reading taken from the bag is in the column headed (onsite). These readings were obtained 8/21/91. Samples of the barrel headspace were obtained by pumping the headspace air into a 5ℓ (12" x 12") TEDLAR® bag. Three days after the initial measurements, the OVM 580A was recalibrated and new measurements taken from the gas sample bags (column headed offsite). It was expected that there might be a general decrease in measurable organics due to adsorption or diffusion. The results for most of the barrels were the same as initially measured or decreased as expected. Two of the barrels (3 and 5) exhibited a significant increase in the ppm of organic vapors monitored. This startling result may be the result of

Table 7 Organic Vapor Monitoring Results

Barrel	Total Organic (ppm) (onsite)	Total Organic (ppm) (offsite)
1	104.4	118.2
2	116.3	109.2
3	1148	2929[1]
4	26.8	22.2
5	494	638
6	39.8	33.3
7	108.6	117.3
8	129.2	111.0
9	245.4	160.0
10	100.4	78.5
11	14.0	11.6
Ambient	0.0	---
Process Blank	0.5	0.5

[1] Reading from bag gave an over-range indication (>2000 ppm). New sample was prepared by diluting 50 mℓ of sample to a total volume of 4050.

loss of some interfering compound which initially decreased the response of the OVM 580A. It was noted during the initial sampling that the instrument took a very long time to stabilize. A recirculating loop was used to allow extended sampling without using up the entire 10ℓ volume available. Contrary to the initial lag in stabilizing, the second reading stabilized very quickly with no evidence of the drift originally observed. The second readings correlate well with the carbon tetrachloride measured by I.R. in a later section.

3.4 Identification of Organic Compounds

3.4.1 Introduction

An attempt was made to identify as many of the organic chemicals found in the barrel headspace samples as possible. Due to the unknown nature of the samples, an I.R. and a G.C. were chosen to maximize the probability of identifying a number of compounds.

Carbon tetrachloride was known to be in some of the barrels. Another gas which was thought probable was methane. Methane can result from bacterial or radiolytic action on the waste.

3.4.2 Infra Red Identification

The Miran IB I.R. was set up in the recirculating mode and a calibration check performed as discussed in a previous section. Gas samples were removed from their TEDLAR® sample bags with an appropriately-sized syringe (20 mℓ to 1ℓ) and injected into the unit. The resultant reading was corrected for dilution and the response factors previously obtained were applied. The results of this monitoring are presented in Table 8.

Barrels 3, 4, and 5 showed significant carbon tetrachloride concentrations. This result is consistent with the notations present on the barrel inventory (see Table 1). The extremely high levels found in the air above Barrels 3 and 5 were somewhat surprising, but are consistent with the relative OVM 580A results. The OVM 580A results are somewhat lower than the carbon tetrachloride estimates by I.R.; however, when corrected for the estimated efficiency of the OVM 580A for measuring carbon tetrachloride, they agreed reasonably well. Barrel 8 also showed significant carbon tetrachloride, although none was noted on the inventory.

Tributyl phosphate (TBP) was also listed as present in Barrels 3, 4, and 5. TBP has a boiling point of 552°F and a vapor pressure of 127 mm at 351°F based on an extrapolated vapor pressure of <0.001 mm Hg. At room temperature, calculations would indicate no detectable TBP.

A standard of TBP was obtained and placed in a sealed vial. After a period of 1-2 hours, the headspace above the liquid was sampled and injected. The purpose of this was to establish a "fingerprint" of peaks from the breakdown of the TBP. Although a distinctive fingerprint was obtained, no clear match was observed in the samples from Barrels 3, 4, or 5. The presence of TBP in the barrels could not be confirmed.

Standards (see Table 4) were run under the various conditions of temperature (30-50°C) and column flow rate (5-20 cc/min) in order to achieve maximum separation of the various compounds.

Table 8 I.R. Results

Barrel	Carbon Tetrachloride	Methane (ppm)
1	<5	1085
2	<5	2509
3	6091	7696
4	42	838
5	2280	<100
6	<5	978
7	<5	296
8	162	789
9	<5	513
10	6	395
11 (control)	<5	<100
Process Control	<5	<100

The levels of carbon tetrachloride in the barrel headspace air are quite high; however, it should be remembered that the resultant ppm is assumed to be the result of equilibrating with the air space inside the barrel. If the rate of evolution of headspace air is assumed constant, then over the 6-day period, it may be assumed that (for example) Barrel 3 emitted 2.25E-3 lb of CCl_4 in a 24-hr period. Even assuming that all of the TRUSAF inventory (~644 barrels) were evolving carbon tetrachloride at the same rate, the emissions from the building would be about 0.24 lb/day. The EPA RQ is 10 lbs/day (40 CFR 3020, thus no FEMP or monitoring would be required.

3.5 Gas Chromatography

Chromatography of air samples from the barrels showed a wide diversity and number of organic compounds. The air samples were run under various chromatographic conditions in order to achieve maximum separation of compounds. Figure 3 shows a chromatogram from one of the barrels.

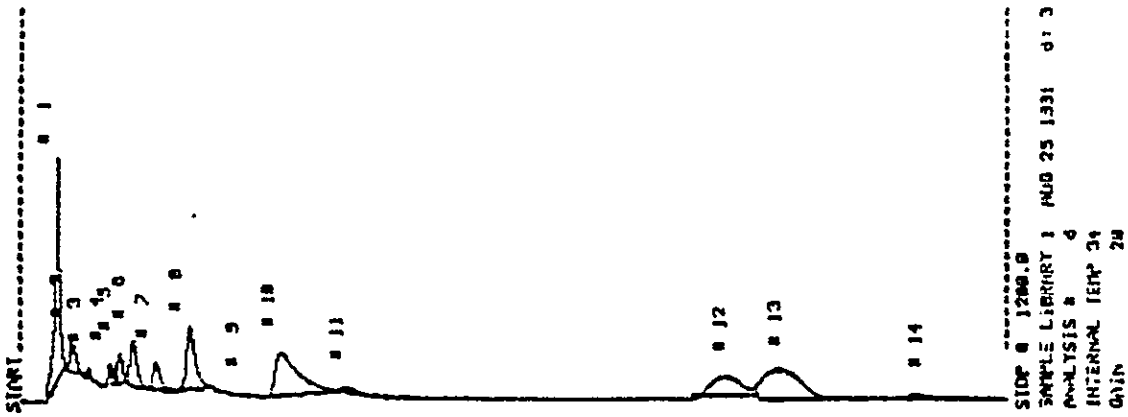

Figure 3 G.C. Chromatogram

Table 9 gives a summary of the estimated number of organic compounds in each barrel headspace, an estimate of the total ppm, and the compounds tentatively identified. In parentheses by each identified compound is an estimated % of the identified compound compared to total organics detected by the photoionization detector (10.7 eV lamp). It should be noted that the G.C. P.I.D. will not detect carbon tetrachloride, methane, methylene, chloride, or other compounds with high ionization potentials.

Table 9 Estimated Number of Organic Compounds Detectable by G.C. and Tentative Identification

Barrel	No. of Organic Compounds[1]	Estimated Conc. (ppm)[2]	Compounds Identified (%)[3,4]
1	7	345	A (11), MEK (3), MIBK (2)
2	6	428	A (22), MEK (3)
3	12	583	A (1), H (2)
4	2	29	B (13)
5	8	145	A (4), B (22)
6	4	135	A (24), B (22)
7	11	486	A (3), MIBK (2), X (1)
8	2	174	A (22), MEK (6)
9	12	612	A (3), MEK (2), H (5), MIBK (18), X (2)
10	6	309	A (16), MIBK (42), T (4)
11 (control)	1	6	----
Process Control	1	0	----

[1] Peaks with area treater than 0.6 ppm equivalent area.
[2] Hexane/MEK equivalent
[3] Based on a retention time within the average ± 1 standard deviation (about 10%) for a standard containing the compound of interest.
[4] Acetone = A, Hexane = H, Benzene = B, Methyl Ethyl Ketone = MEK, Methyl Isobutyl Ketone = MIBK, Xylene = X, Toluene = T. (___) = % of total estimated concentration.

The choice of hexane/MEK equivalent concentration in Table 9 was an attempt to make an extremely conservative estimate of the maximum total ppm organic compounds that could be measured. If the barrel with the highest ppm (Barrel 9) is selected, we can calculate the maximum evolution of organic compounds. In the conversion from ppm to mg/m^3, xylene was used (1 ppm = 4.41 mg/m^3) because it was the heaviest volatile organic compound suspected to be present and represent a conservative assumption with regard to the subsequent calculation of pounds per day emitted. If we assume that the concentration of the 10ℓ barrel headspace measured was one-sixth of the final measured concentration per day, then the emissions of Barrel 9 would be 9.91×10^{-6} lb/day. Further, assuming all 644 barrels in the inventory were emitting at the same rate, the total emissions per day would be 0.0063 lbs. This is approximately three orders of magnitude below the lowest EPA RQs in 40 CFR 302 (10 lb/day) of the compounds suspected to be present. Thus, no FEMP is required.

3.6 Conclusions

A large number of organic compounds were found to accumulate in the headspace above barrels of TRU waste. In some cases, the ppm levels were greater than 1000 ppm. Calculation of worst-case release scenarios for barrels with the highest levels of contaminant demonstrated that releases were all below levels of EPA reportable quantities by two to eight orders of magnitude. Thus, there is no requirement for a FEMP based on emissions of Hg, CCl_4, and volatile organics.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Al Robinson
Senior Scientist

drs

cc: G. Martin
M. Moeller
File/LB

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PART 12

CENTRAL WASTE COMPLEX FACILITY

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

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CONTENTS

LIST OF FIGURES

LIST OF TERMS

CAM	continuous air monitor
CFR	Code of Federal Regulations
CH-TRU	contact-handled transuranic
CWC	Central Waste Complex
DCG	Derived Concentration Guides
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EDE	effective dose equivalent
FEMP	facility effluent monitoring plan
HW	hazardous waste
HWAC	Hanford Site Solid Waste Acceptance Criteria
LLW	low-level waste
LSA	low specific activity
MW	mixed waste
PE-Ci	^{239}Pu Equivalent curies
PU/PCB	plutonium/polychlorinated biphenyl
TRU	transuranic
WAC	Washington Administrative Code

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CENTRAL WASTE COMPLEX FACILITY

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

1.0 INTRODUCTION

This document provides information to determine if a facility effluent monitoring plan (FEMP) is required for the Central Waste Complex (CWC) Facility and ancillary systems. This document has been prepared in accordance with *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* (WHC 1991). This document provides basic information for the FEMP determination.

2.0 FACILITY DESCRIPTION

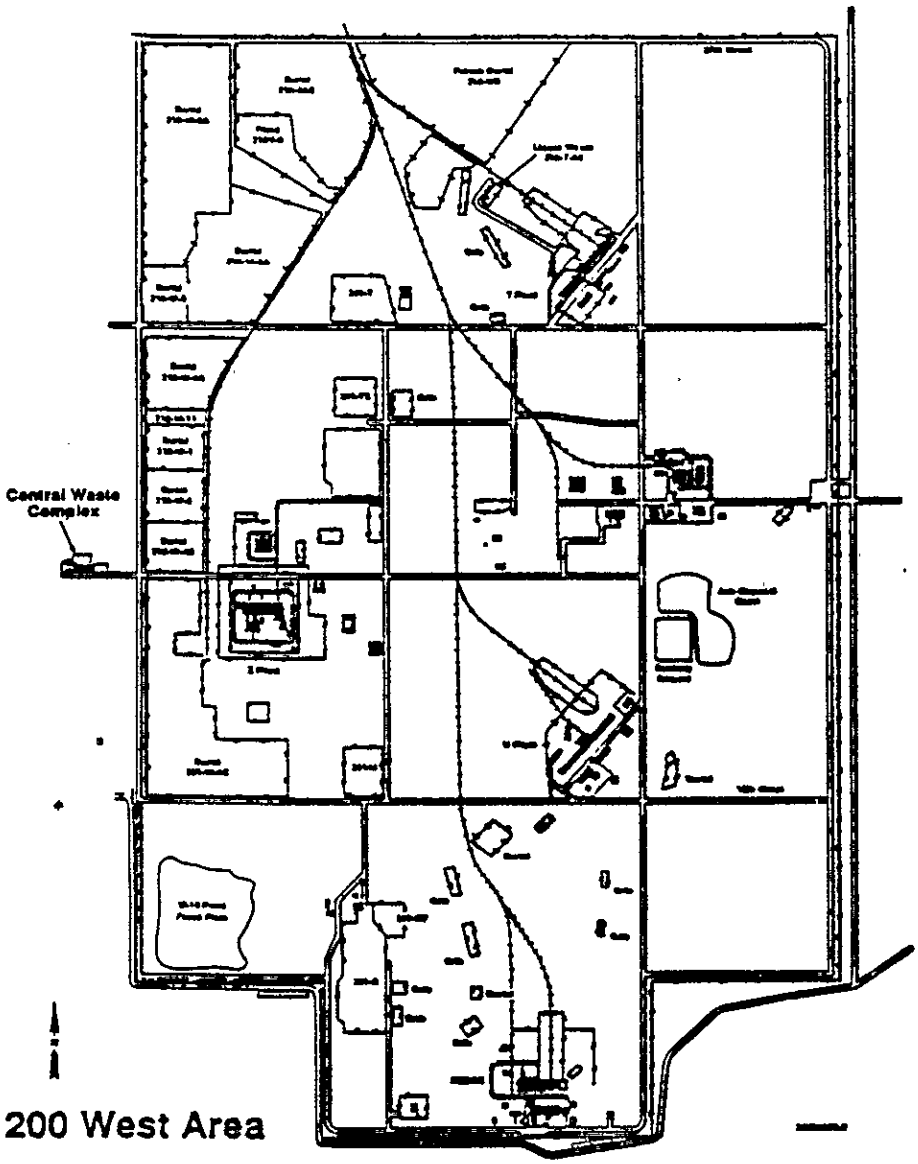
The CWC is a group of structures located on the west side of 200 West Area (see Figure 2-1) exclusion zone on the Hanford Site. The Hanford Site is located in the south central region of Washington State. The primary function or process associated with the CWC Facility is the receipt and storage of radioactive and mixed waste (MW), which is currently ongoing. The functions or processes associated with these facilities result in the storage and management of radioactive and hazardous materials. The functions or processes associated with these facilities have the potential to generate radioactive airborne and hazardous airborne, and radioactive liquid and hazardous liquid effluent. The CWC is used for the receipt and storage of radioactive and mixed waste. The facility (Figure 2-2) consists of the following:

- Plutonium/Polychlorinated Biphenyl (Pu/PCB) Storage Facility (2401-W)
- Eight Low Flashpoint MW Storage Modules
- Mixed Waste Storage Facilities (2402-WB through 2402-WL, 2402-W, and 2403-W [Phase 1 of future development])
- Mixed Waste Storage Pad
- Receiving and Staging Pad.

2.1 PLUTONIUM/POLYCHLORINATED BIPHENYL STORAGE FACILITY

This facility is a preengineered steel building 50 ft by 80 ft by 20 ft and has 6 in. of concrete curbing within its perimeter. The building has a water-based fire suppression system. This facility also has continuous air monitors (CAM) to detect airborne radioactive particulates.

Figure 2-1. Central Waste Complex Location.



2.2 LOW FLASHPOINT MIXED WASTE STORAGE MODULES

Each of the Low Flashpoint MW Storage Modules is a preengineered structure 22 ft 8 in. by 9 ft by 8 ft 7 in. Each module has a 4-in.-deep catch sump (750-gal). Modules used for storage of transuranic (TRU) MW also have draft ventilation.

2.3 MIXED WASTE STORAGE FACILITIES

Buildings 2402-WB through 2402-WL and 2402-W are 50 ft by 80 ft by 20 ft. They are metal structures with concrete floors, ventilation systems, and water-based fire protection. The floor has a 6-in. curb around its perimeter within the structure. These facilities have CAMs to detect airborne radioactive particulates.

Building 2403-W is a metal building 170 ft by 200 ft by 20 ft with concrete floors, a ventilation system, and a water-based fire protection system. This building has a sloped floor with trenches to collect liquids (60,000 gal capacity) and CAMs to detect airborne radioactive particulates. When a CAM alarms, the dampers close on the ventilation system.

2.4 MIXED WASTE STORAGE PAD

The MW Storage Pad is a 9,000-ft^2 concrete storage pad with 6-in. curbing around its perimeter. The pad has a rainwater collection system that allows for disposal after sampling.

2.5 WASTE RECEIVING AND STORAGE PAD

The Waste Receiving and Storage Pad is a 200-ft by 150-ft asphalt pad.

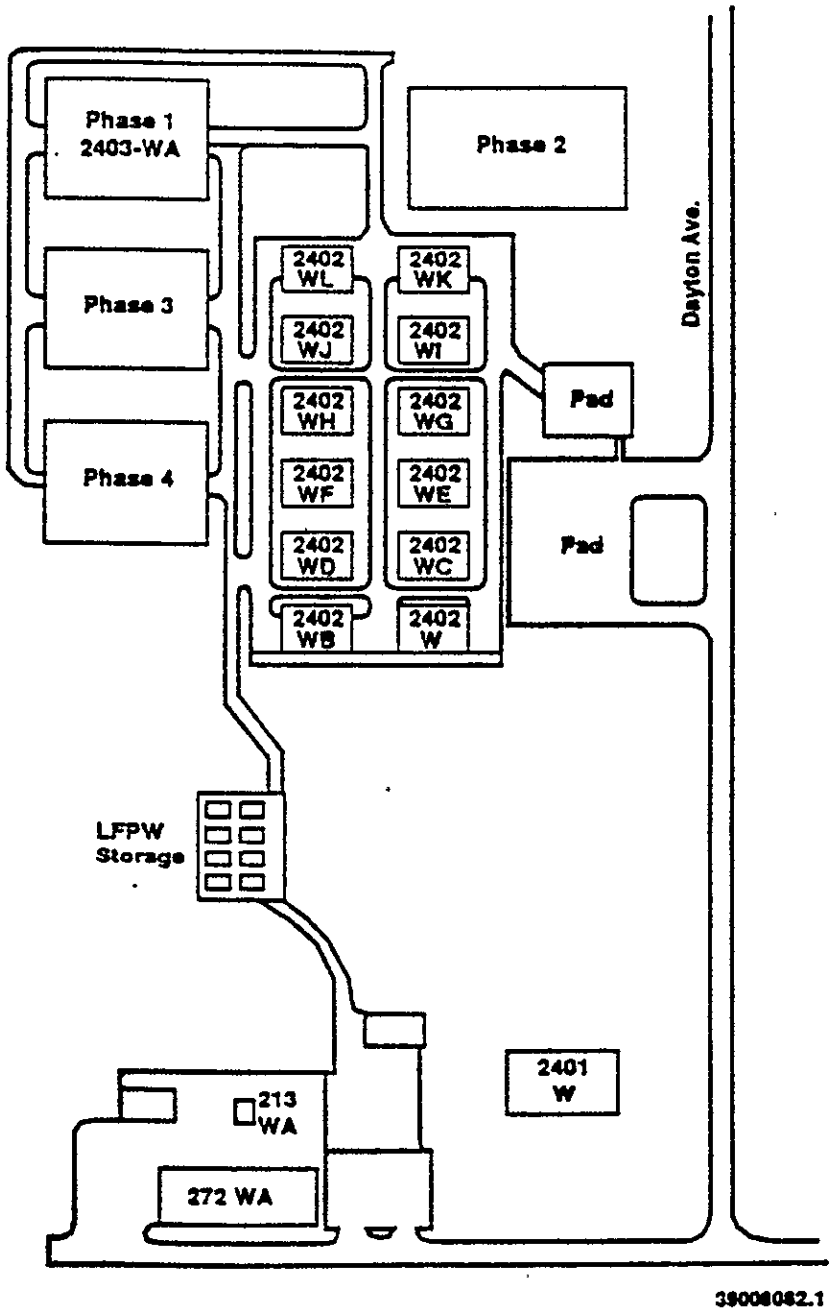
2.6 FUTURE EXPANSION

Figure 2-2 shows phases 2, 3, and 4 of the CWC development. The buildings indicated on this figure would be MW storage facilities similar to the 2403-WA Building. In addition, Low Flashpoint Storage Modules may possibly be added in the future. None of these possibilities will affect the result of this evaluation as long as the basic design characteristics of the facilities (specified in this evaluation) and the characteristics of the material stored are unchanged.

2.7 RECEIVING AND STORAGE

The CWC receives and stores TRU waste, low-level waste (LLW), and MW from the Hanford Site and other facilities. When the waste is accepted by the CWC, it must be in compliance with the Hanford Site Radioactive Solid Waste Acceptance Criteria (HWAC) (WHC-EP-0063-2) (Willis 1990). The waste is received in U.S. Department of Transportation (DOT) Specification 7A or equivalent packaging (typically four 55-gal drums banded to a pallet) at the

Figure 2-2. Central Waste Complex Layout.



Waste Receiving and Storage Pad. The receipt consists of inspecting and unloading the shipment. Unloading is typically accomplished using a forklift, although other equipment (e.g., cranes, handtrucks) may be used as needed. The waste is then transferred to the appropriate storage facility. In some cases, the waste will be received at the appropriate storage facility rather than at the Waste Receiving and Storage Pad.

The activities at the MW storage pad are typically limited to removing the waste containers and transferring items to one of the other appropriate storage facilities on a time-and-space available basis.

Out-of-specification containers are typically stabilized and held on the Waste Receiving and Storage Pad until they are either returned to the shipper or the out-of-specification condition is corrected.

3.0 STATUS OF OPERATIONS

3.1 PAST PRACTICES

This is a new facility. Before its construction, the wastes discussed in this document were either disposed of or retrievably stored in the Hanford Site Burial Grounds.

3.2 CURRENT PRACTICES

The containers are placed in the appropriate storage facilities. Incompatible waste is separated based on applicable requirements and procedures within a facility. Stacks are no more than 3 containers or 10 ft high, whichever is lower. The facility and the containers are routinely monitored for degradation. Liquid collected in sumps or trenches is sampled before disposal. If the liquid contains radioactive or hazardous material in concentrations unacceptable for uncontrolled release (later referred to as significant quantities of material), it is sent to the appropriate liquid-waste processing facility outside the CWC for treatment before disposal. Any liquid collected in the facilities would not contain significant quantities of radioactive or hazardous material except possibly in an upset or accident condition.

Only a small number of containers are present on the Receiving and Staging Pad at any one time and no container can remain there for more than 30 d. On receipt and acceptance at the CWC, the container is visually inspected. If the container is unacceptable, it is stabilized and then either returned to the shipper or subjected to corrective action on the pad. Corrective action taken on the pad does not involve activities that might result in the release of material to the environment.

3.3 FUTURE PRACTICE

An ongoing change to this facility is the removal and transfer of the waste from the MW Storage Pad to other storage locations within the facility. This change further decreases any risks associated with this facility; therefore, no change in this evaluation should be required.

Another future and potential ongoing practice is the removal of containers from the CWC for inspection, repackaging, processing, disposal, or other activities. Assuming that this activity is consistent with current practices, the considerations in this evaluation will adequately address this activity.

4.0 SOURCE TERM

4.1 IDENTIFICATION AND CHARACTERIZATION OF POTENTIAL SOURCE TERMS

The characteristics of the waste within the containers and the containers themselves are based on these primary references:

- *Hanford Site Radioactive Solid Waste Acceptance Criteria* (HWAC) (WHC-EP-0063-2) (Willis 1990)
- Dangerous Waste Permit Application (EPA/State I. D. # WA7890008967) for the Hanford Central Waste Complex (DOE/RL 88-21, Rev. 0).

4.2 WASTE TYPES

4.2.1 Transuranic Waste

The TRU waste typically contains rags, paper, rubber gloves, disposable supplies, broken tools, industrial waste (e.g. failed equipment), solidified process byproducts, and laboratory wastes that are contaminated with TRU material. This waste must contain at least 100 nCi of TRU material per gram of waste or it is considered LLW. In addition, this material is TRU waste only if no economic method of recovering the transuranic material is available.

The TRU waste accepted by the CWC may contain varying concentrations of various TRU radionuclides and limited amounts of non-TRU radionuclides. Only contact-handled TRU (CH-TRU) waste is accepted at CWC. The CH-TRU waste has a dose rate on the outside of the container of less than 100 mrem/h. Thus, the hazard from the non-TRU radionuclides is not significant compared to the TRU radionuclides when assessing the hazard to the public from this waste. The TRU radionuclides are limited to concentrations less than 3.6 ^{239}Pu equivalent curies (PE-Ci). Since the activity limit is expressed in terms of PE-Ci, the radionuclide distribution identification is not critical. The PE-Ci unit is

designed to control inhalation dose impacts independent of radionuclide type. The hazardous material component of this waste form is addressed in Section 3.1.3.

4.2.2 Low-Level Waste

The LLW typically contains rags, paper, rubber gloves, disposable supplies, broken tools, industrial waste (e.g. failed equipment), solidified process byproducts, and laboratory wastes that are contaminated with radioactive material. This waste is considered LLW only if it contains radioactive material and is not classified as TRU waste, high-level waste (see 40 Code of Federal Regulations (CFR) 191 [EPA 1989a]), or spent nuclear fuel. Material can also be LLW if it is a waste meeting the definition of byproduct material in DOE Order 5820.2A, *Radioactive Waste Management* (DOE 1988a).

All LLW accepted for storage at the CWC must meet the criteria established in 40 CFR 173 (EPA 1988) for low specific activity (LSA) or Type A quantities. The material has historically contained primarily ^{90}Sr and ^{137}Cs; however, other radionuclides may be present as well. Two radionuclides that might impact this determination are tritium (H-3) and ^{129}I. Transuranic radionuclides may also be present in concentrations up to 100 nCi/g, but the impact of this material is adequately addressed in the CH-TRU waste discussion in Section 3.1.1. Because this material is limited to LSA and Type A quantities, this waste form is significantly less hazardous (based on inhalation dose) than CH-TRU. (Note: CH-TRU container limits are more than 1,000 times greater than Type A quantities.)

4.2.3 Hazardous Waste

The hazardous waste (HW) typically contains rags, paper, rubber gloves, disposable supplies, broken tools, industrial waste (e.g., failed equipment), solidified process byproducts, and laboratory wastes that are contaminated with hazardous material [see 40 CFR 302 (EPA 1989b)]. A waste is also considered HW if it is defined by the Washington State *Dangerous Waste Regulations* [Washington Administrative Code (WAC) 173-303-040(18) (WAC 1989)] as a dangerous waste. Wastes that are both radioactive and hazardous are designated as mixed waste.

Hazardous waste is also present in much of the waste stored at the CWC. The criteria limiting the presence of HW in the containers in this facility are specified in the HWAC (Willis 1990). A summary of the HW that may be present is provided in the permit application. Typically, more than reportable quantities of the various hazardous material may be present in the CWC.

4.3 WASTE FORM

The waste accepted by the CWC will be in DOT Specification 7A packaging with an inner liner providing additional containments. No free liquid may be present in the container. If liquid is present in the container, it must meet the following criteria:

- Absorbed into a waste matrix capable of holding twice the volume of liquid present
- Packaged in an inner leak-resistant container (1 to 5 gal depending on container type) and surrounded by sufficient absorbent material to absorb twice the volume of liquid present.

The waste form must meet the requirements of the HWAC (Willis 1990), which greatly reduces the potential for release. The requirements were developed to reduce the probability, magnitude, and impact of a release caused by an upset condition or accident.

4.4 RELEASE MECHANISM

Two effluent pathways (airborne and groundwater releases) exist for this facility. For routine operations, there is no liquid effluent pathway because no liquid waste is generated without an upset or accident condition existing. The rain water runoff from the Receiving and Staging Pad would not contain significant quantities of radioactive or hazardous material unless it related to an upset condition. The airborne effluent pathway for routine operations at this facility relate to the following:

- Resuspension of radioactive contamination from the containers, which are within the applicable contamination limits. (The area where this release would occur is continuously monitored with CAMs to detect and alarm if a significant release occurs.)
- The evaporation of tritium, iodine, or hazardous materials through the container vents.

Neither of these effluent pathways will produce a significant release compared with upset conditions, so it is only necessary to address the upset conditions.

4.4.1 Liquid Effluent

As indicated, the presence of free liquids in these containers is not allowed (Willis 1990). Approximately 1,500 drums have been received to date and only 21 leakers have been identified. The largest volume leaked appears to have been approximately 1 cup. These releases were identified on the Waste Receiving and Storage Pad during receipt inspection. Releases within most of the facilities do not result in any effluent because they are contained within the sumps and sent to appropriate treatment facilities. If the fire protection system were inadvertently activated, water could be released into the facility. However, this water would be contained in the sumps and would

not typically contain a significant amount of radioactive or hazardous material. The sprinkler system activation may lead to water infiltrating through the filtered vent on some drums, but this would not result in an effluent release because the liquid would be contained within either the drum or the facility.

If liquid is released on the Waste Storage and Receiving Pad, which is the only part of this facility without a sump system, it maybe be considered an effluent. However, the potential release is about 1 cup of liquid, and thus is not a sufficient quantity to run off the pad. Rather, it would probably not reach the pad but would be restricted to the container and the pallet.

Leaking drums are historically associated with drums containing solid waste, which either contain a small amount of liquid added in error or condensate buildup from the natural environment. The containers with absorbed or contained liquid typically do not have this problem because there is sufficient absorbent to contain this additional liquid (including under upset conditions). Once a leaking container is identified, it is stabilized so the leak is stopped or contained, and actions are implemented to correct the problem. This information about container performance is consistent with the liquids packaging requirements. The materials sent to the CWC are packaged so the material cannot escape from the packaging. (The 21 containers that have minor leaks identified are from a single shipper and potential corrective actions are being evaluated.) Based on this information, the rain water runoff from the Receiving and Staging Pad would not contain significant quantities of radioactive or hazardous materials. This information indicates that the characteristics of the waste form, and the packaging and handling of this waste ensure that no significant liquid volume is available for release. These containers do not constitute a source of an effluent from a routine or upset (leaking container) condition. Thus, there is no potential for a release to the liquid pathway of a reportable quantity of liquid from the facility caused by routine or upset conditions.

4.4.2 Airborne Effluent

There is a potential for airborne effluent associated with upset conditions at this facility. Various possible upset conditions are possible, including the following:

- The resuspension of material and its escape from a drum through a leak based on atmospheric pressure differential
- The breaching of a drum during handling activities by dropping it more than 4 ft. (DOT Specification 7A packagings/containers are designed to survive a 4-ft drop without release of their contents.) The handling accident is clearly the controlling upset condition because it results in the release of more of the container contents based on a review of CWC activities.

4.4.2.1 Handling Upset Conditions Involving Radioactive Material. A multiple drum breach because of a seismic event was analyzed for this facility. Using the results of this accident analysis, it is possible to bound the handling

upset condition being considered in this evaluation. It is necessary to note that only one drum is involved and that less than 1% of the material in the drum can be in respirable fines (see HWAC [Willis 1990]). (Although four drums are typically banded together on a pallet, it is likely that only one of the drums would breach. If all four drums breached, it would result in an increase in impact of less than a factor of four, so the conclusions of this evaluation would be unchanged.)

Assuming the drum is a CH-TRU container with 3.6 PE-Ci, there would be less than 0.036 PE-Ci (the respirable fraction) available for release from the drum that could reach the public. A CH-TRU container with maximum loading is considered to ensure a conservative evaluation. This container would have maximum impact. [The CH-TRU container has maximum impact because of the extremely high radiotoxicity of ^{239}Pu. As can be seen by reviewing the Derived Concentration Guides (DCG) for the public in U.S. Department of Energy (DOE) Order 5400.5, (DOE 1990).] The accident analysis projects a release fraction of 1×10^{-4}. Thus, the projected handling upset would result in a release of 2.5×10^{-6} Ci of ^{239}Pu.

Pacific Northwest Laboratory has supplied CAP-88 (Beres 1990) data for the assessment of the effective dose equivalent (EDE) to the maximally exposed member of the public. Based on these data, a ground-level release of 2.5×10^{-6} Ci of ^{239}Pu will result in an EDE of less than 1.3×10^{-5} mrem to the maximally exposed member of the public. This assumes a 1-yr residency time and that this individual is located 24,000 m from the release point.

4.4.2.2 Handling Upset Condition Involving Hazardous Material. Based on an evaluation of the potential upset conditions, no significant impact to the public from an airborne release of hazardous material occurs during accident conditions. Based on this determination, no impact would result from the significantly less severe potential upset conditions.

4.5 APPLICABLE REGULATIONS

This facility is regulated by the *Clean Air Act of 1977* (Public Law 95-95), *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (Public Law 96-510), and the *Clean Water Act of 1977* (Public Law 95-217). However, because there is no liquid effluent path from this facility, the *Clean Water Act* and its implementing regulations apply to this facility only as related to determining whether there is a potential effluent stream. The primary implementing regulations applicable to this facility include the following:

1. 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants (NESHAPs)" (EPA 1989c)

2. 40 CFR 261, "Identification and Listing of Hazardous Waste" (EPA 1989d)

3. 40 CFR 302, "Designation, Reportable Quantities and Notification" (EPA 1989e)

4. DOE Order 5484.1, *Environmental Protection, Safety, and Health Protection Standards* (DOE 1981)

5. DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988b)

6. DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1990)

7. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental surveillance*

8. Washington Administrative Codes, 1989, *Dangerous Waste Regulations, Chapter 173 - 303* (WAC 1989).

The requirements imposed by the DOE Field Office, Richland, for the preparation of FEMPs are also applicable to this facility.

4.6 IDENTIFICATION AND CHARACTERIZATION OF POTENTIAL SOURCE TERMS CONTRIBUTING TO EACH EFFLUENT STREAM

Several potential effluent streams are associated with the CWC. They are summarized as follows:

1. Radioactive and hazardous material (within acceptable limits) present on the exterior surface of the container, which may then be resuspended. Based on the information in Section 3.0, this is not a significant effluent source. This effluent is released through the facility exhausts and structure doors directly to the air for the pads.

2. Radioactive and hazardous material (within acceptable limits) present within the container, which may then be released through a container vent or leak. Based on the information in Section 3.0, this is not a significant effluent source. This effluent is released through the facility exhausts and structure doors directly to the air for the pads.

3. Radioactive and hazardous material released during upset conditions. Based on the information in Section 3.0, this may be a significant effluent source. This effluent is released through the facility exhausts and structure doors directly to the air for the pads.

4. Effluent collected in facility sumps (trenches and curbed areas) are a potential effluent pathway. This liquid is sampled and, if significant amounts of radioactive or hazardous material are present, it is sent to another facility for treatment. (The only source of significant amounts of radioactive or hazardous materials is an upset or accident condition.) If no significant amounts of such material are present, this liquid is pumped from the sump and disposed of through the existing sewer system. Thus, these facilities have no liquid effluent.

5. Effluent collected in the MW Pad sump is a potential effluent pathway. This liquid is sampled and, if significant amounts of radioactive or hazardous material are present, it is sent to another facility for treatment. (The only source of significant amounts of radioactive or hazardous materials is an upset or accident condition. Liquid may be present in this system because of rain water collected from the pad.) If no significant amounts of such material are present, this liquid is drained into the existing sewer system through a controlled piping/valve system. Thus, there is no significant liquid effluent from these facilities that would require monitoring.

6. Rain water runoff from the Receiving and Staging Pad is a source of liquid effluent. Based on the information in Section 3.0, this water has no potential to contain significant quantities of radioactive or hazardous material. Thus, no liquid monitoring is required for this area.

4.7 EFFLUENT POINT DISCHARGE DESCRIPTION SECTION

The potential airborne effluent release points are the ventilation exhausts for each of the facilities, the general area of the MW Storage Pad, and the Receiving and Staging Pad. In addition, airborne releases may occur through facility doors and when material is in transit to a specific storage facility. One source of liquid effluent is water collected in sumps, which, if it contains significant quantities of radioactive or hazardous material, is sent to treatment facilities rather than released as an effluent. The other source of liquid effluent would be rain water runoff from the Receiving and Staging Pad, which would not contain significant quantities of radioactive or hazardous materials. Potential effluent release points will be periodically sampled to confirm release quantities. The specifics of the sampling would be addressed in a sampling and analysis plan for the facility.

4.8 HISTORICAL MONITORING/SAMPLING DATA FOR THE EFFLUENT STREAMS

There are currently no effluent monitors on the CWC airborne effluent streams and no liquid effluent streams have been identified for the CWC. However, radioactive airborne environmental monitoring data do exist for the area. Figure 4-1 summarizes the location of the environmental airborne radioactivity monitors in the 200 West Area. The DCGs from DOE Order 5400.5 (DOE 1990) are concentration values that result in an exposure of 100 mrem EDE from a continuous yearly exposure to this concentration. Because the determination level for a FEMP is 0.1 mrem EDE, 0.1% of the DCG would be the concentration exposure limit for the public if a FEMP is not required. Based on the data in the *Westinghouse Hanford Company Environmental Surveillance Annual Report - 200/600 Areas (WHC-EP-0145-2)* (Schmidt 1990), the concentrations at the CWC during this period (see electronic data processing codes N153, N986, and N987) did not exceed 0.1% of the DCG at the source. This is based on the result reported for ^{239}Pu, ^{137}Cs, and ^{90}Sr, which are the radionuclides of interest. In fact, as can be seen from Figures 4-2, 4-3, and 4-4, the airborne concentration from all of West Area, based on

Figure 4-1. The 200 West Area Showing Locations of Air Samplers.

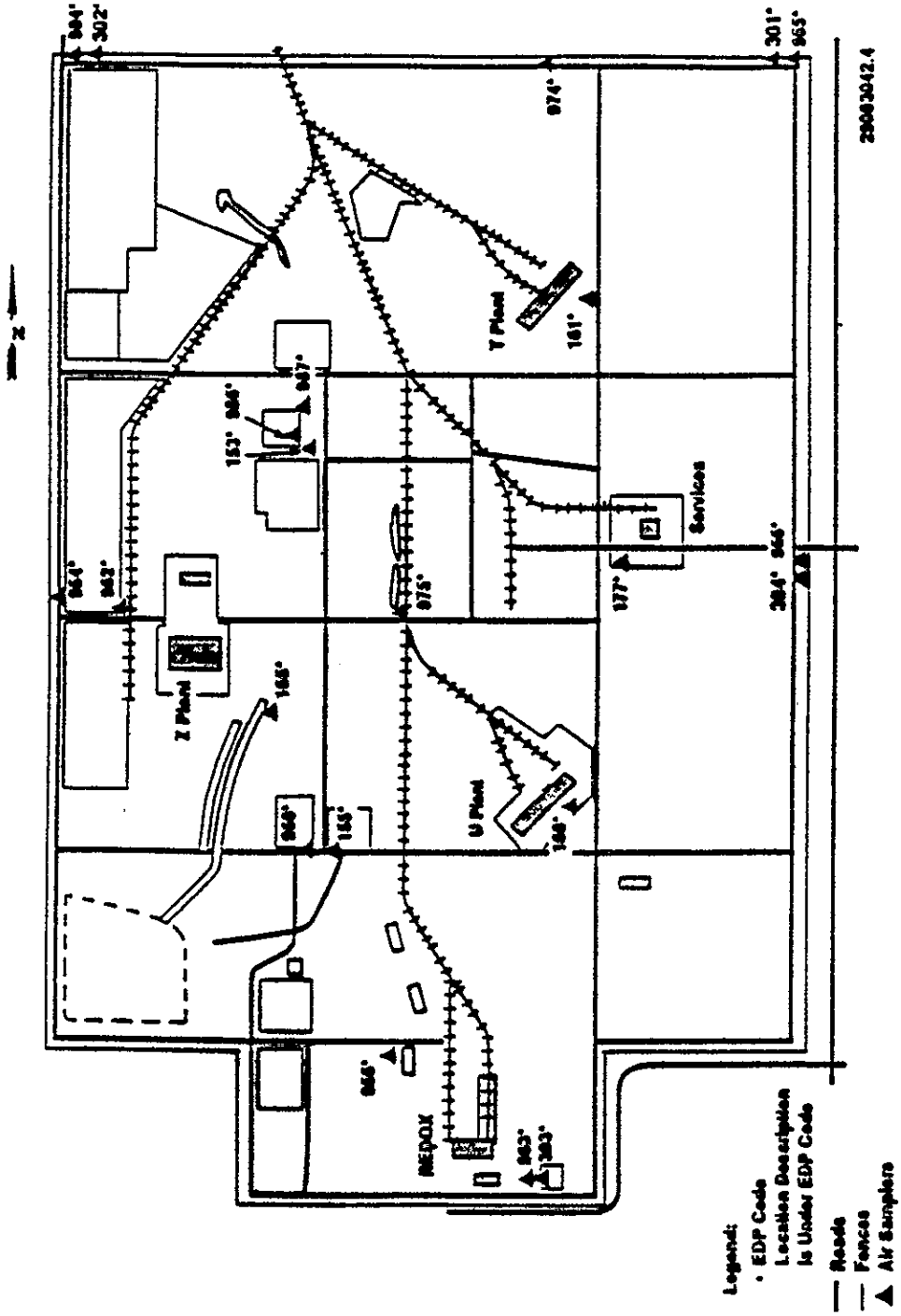


Figure 4-2. The Strontium-90 in Air, 200 West Area.

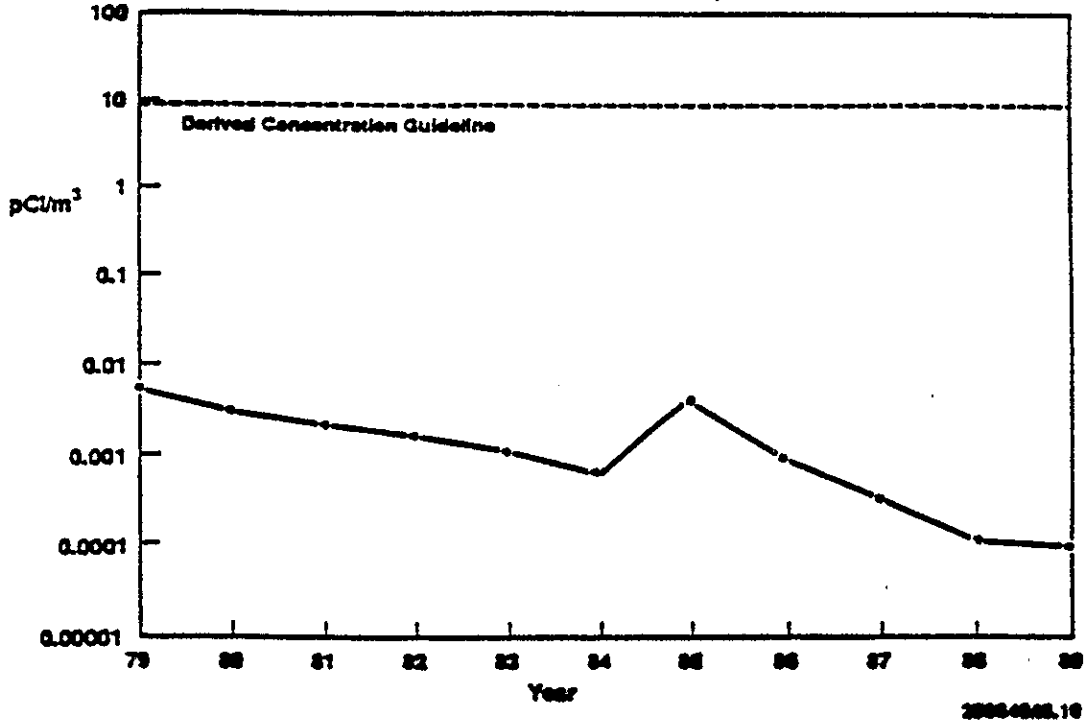


Figure 4-3. The Cesium-137 in Air, 200 West Area.

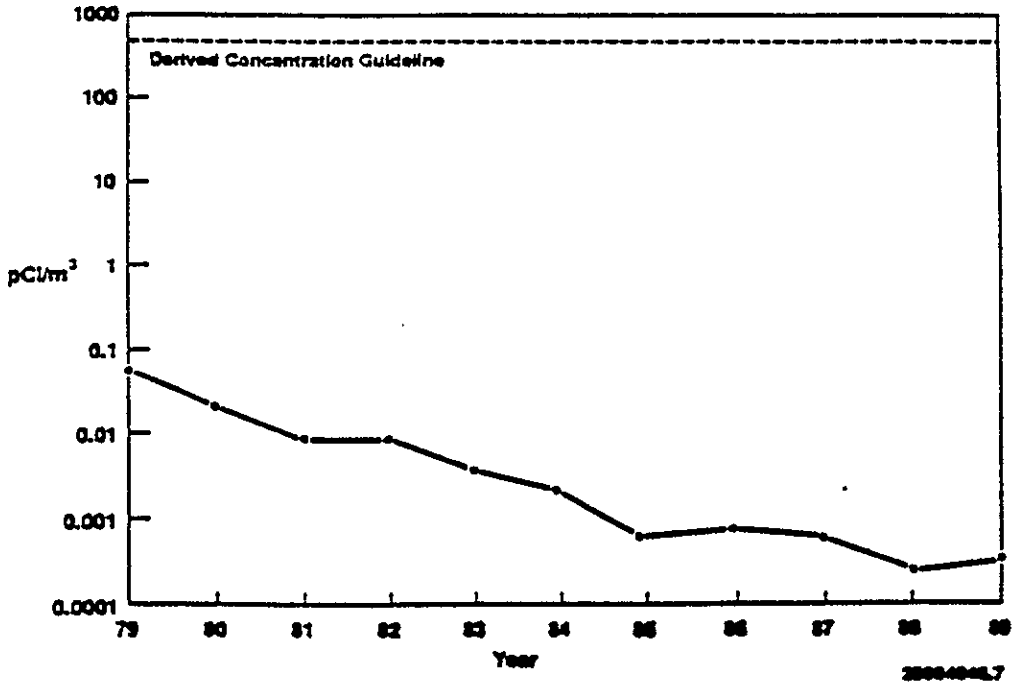
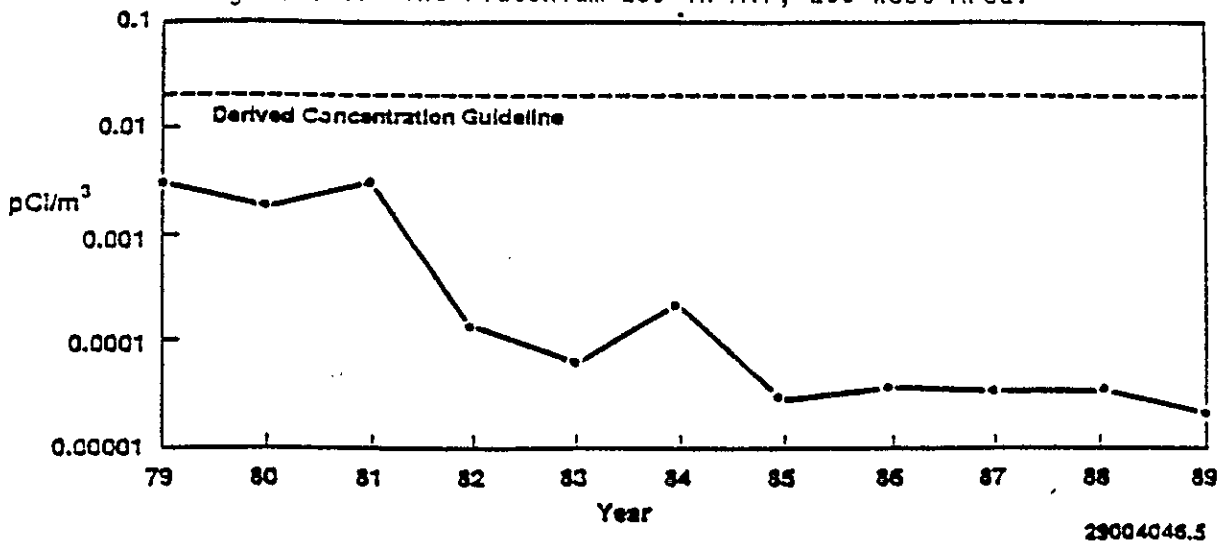


Figure 4-4. The Plutonium-239 in Air, 200 West Area.



Schmidt (1990), are now consistently below 0.1% of the DCG at the source since 1988. The CWC is a recent facility; therefore, data before 1988 are not applicable.

5.0 POTENTIAL UPSET-OPERATING CONDITIONS

There is no routine or upset condition that can lead to a dose to the public approaching 0.1 mrem. The results of the environmental surveillance program (WHC-EP-0145-2) (Schmidt 1990) are consistent with these findings. Furthermore, although reportable quantities of hazardous material are present at the CWC, there appears to be no mechanism for the routine release of significant or reportable quantities of these materials. Further, there are no upset conditions that would result in such a release. This evaluation does not address the requirements for the effluent processing/treatment system used to treat liquid effluent from upset conditions at the CWC. Those liquids are sent to independent facilities for this treatment.

The potential radioactive airborne effluent releases during both routine and upset facility operating conditions has been evaluated. The evaluation indicates that the radiation EDE to the maximally exposed member of the general public would be less than 0.1 mrem/yr, which represents 1% of the radioactive airborne effluent release limit standard of 10 mrem/yr. Based on the data, it appears that a FEMP is not required for this release pathway.

The upset condition for the facility to generate radioactive airborne effluent is a container breach during handling. The release fraction used to calculate the release is 1×10^{-6} for the container contents, based on less than 1% of the material being in respirable form and a release fraction of 1×10^{-4}.

Information on the potential hazardous airborne effluent releases during both routine and upset facility operating conditions indicates that the quantities of hazardous materials at the point of discharge to the environment will not exceed applicable reportable quantities for regulated substances. Specific information is presented in Attachment 1. Based on the data, it appears that a FEMP is not required for this release pathway.

The upset condition for the facility to generate hazardous airborne effluent is a container breach during handling. Assessments show that even in the more severe accident conditions, there is no significant exposure of the hazardous materials.

Information on the potential radioactive liquid effluent releases during both routine and upset facility operating conditions indicates that no detectable (significant) release would occur. Although no radioactive material is present in the effluent stream, it is prudent to document the criteria against which the assessment of regulatory compliance has been performed. Thus, the EDE (related to this facility) to the maximally exposed member of the general public consuming the water from this area would be less than 4 mrem/yr, which represents a dose limit from a radionuclide or mixture

of radionuclides at a level of 4% of the DCG value. Specific information is presented in Attachment 1. Based on the data, it appears that a FEMP is not required for this release pathway.

Information on the potential hazardous liquid effluent releases during both routine and upset facility operating conditions indicates that the quantity of hazardous materials at the point of discharge is essentially zero. Thus, this effluent pathway will not exceed applicable reportable quantities for regulated substances. Specific information is presented in Attachment 1. Based on the data, it appears that a FEMP is not required for this release pathway.

6.0 SUMMARY

Based on the information collected and the data reviewed, the FEMP determination for the Central Waste Complex Facility indicates that a FEMP will not be required. This determination considered radioactive and hazardous materials present during routine and upset operating conditions and the potential releases for airborne and liquid effluent pathways.

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

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Attachment 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY Central Waste Complex **DISCHARGE POINT:** Surrounding Environ.

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/Chemical Form	Quantity (Curies)	Quantity Released	Projected (mrem/yr)
1.	^{239}Pu	Various	<520	<3.6 E-06	<1.3 E-0
2.	^{90}S	Various	<10,000[$]	[NL]	<1.3 E-05 [NL]
3.	^{137}Cs	Various	<250,000[$]	[NL]	<1.3 E-05 [NL]
4.	^{129}I	Solid/Various	<<50,000[$]	[NL]	<1.3 E-05 [NL]
5.	Misc.*	Various		[NL]	<1.3 E-05 [NL]
Total					

* Various other radionuclides may be present. Those listed are limiting [additional information can be found in the Hanford Central Waste Complex Final Safety Assessment Document (SD-WM-SAR-041, Rev.)].

[$] The total activity for any non-TRU radionuclide is limited to the 25,000 drum inventory of the CWC times the A2 value for the radionuclide in the Table in 49 CFR 173.435. However, the actual non-TRU activity present would be a small fraction of this value. Thus, the number indicated assumes this radionuclide is the only one present and that every drum in the inventory is loaded to the A2 value. Clearly, the exact opposite is true but there is no facility limitation that requires this. TRU material is limited to 3.6 PE-CI per container and 520 PE-CI for the facility.

[NL] This material is not a significant contributor to the total release.

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated Material	Quantity (lbs)	Quantity Released	Reportable Quantity (lbs)	% of RQ Quantity/Year
1.	PCB	22,000	[ND]	10	~0
2.	Lead	100,000	[ND]	1	~0
3.	Mercury	500	[ND]	1	~0
4.	Various[@]	Various	[ND]	Various	~0

[@] Many other Hazardous Materials are present, they are listed in the attached Dangerous Waste Permit Application (EPA/State I.D. Number WA7890008967) (DOE/RL 88-21) by identification number. A large number will be presented at more than 100% of the reportable quantity. However, as discussed in the attached Evaluation of Requirements for a FEMP for the Central Waste Complex there is no potential for release of greater than the reportable quantity of these materials at this facility due to the nature of the waste form, packaging, and facility type and operation.

Attachment 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

[ND] Not detectable.

Identification of Reference Material

See listing of references in attached supporting material

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP not required X

EVALUATOR Robert E Bell * DATE 5/8/91

MANAGER, ENVIRONMENTAL J M Nickels DATE 5/20/91

FACILITY MANAGER D E Hay DATE 5/13/91

PART 13

LOW-LEVEL BURIAL GROUNDS

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

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CONTENTS

LIST OF FIGURES

LIST OF TERMS

ALARA	as low as reasonably achievable
CERCLA	*Comprehensive Environmental Response Compensation and Liability Act of 1980*
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
Ecology	Washington State Department of Ecology
FEMP	Facility Effluent Monitoring Plan
LLBG	Low-Level Burial Grounds
LLW	low-level waste
NRC	Nuclear Regulatory Commission
RCRA	*Resource Conservation and Recovery Act of 1976*
RQ	reportable quantity
SAR	Safety Analysis Report
TRU	transuranic
WAC	Washington Administrative Code
WRAP	Waste Receiving and Processing Facility
Westinghouse Hanford	Westinghouse Hanford Company

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LOW-LEVEL BURIAL GROUND

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

1.0 INTRODUCTION

This document provides information to determine if a Facility Effluent Monitoring Plan (FEMP) is required for the Low-Level Burial Grounds (LLBG). This document has been prepared in accordance with *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* (WHC 1991).

2.0 FACILITY DESCRIPTION

The active radioactive solid waste burial grounds to be addressed under this FEMP determination are located in the 200 Areas of the Hanford Site. The active sites to be considered are those addressed in Part A of the Dangerous Waste Permit Application for the Low-level Burial Grounds.

The LLBG are classified as a landfill and cover a total area of approximately 518 acres. The landfill is divided into eight burial grounds. Each burial ground is comprised of a number of trenches. Six burial grounds are located in the 200 West Area and two burial grounds are located in the 200 East Area. In the 200 West Area the burial grounds to be considered include 218-W-5, 218-W-6, 218-W-3A, 218-W-3AE, 218-W-4B, and 218-W-4C. In the 200 East Area the burial grounds include 218-E-10 (Expansion), 218-E-10, and 218-E-12B. Figures 1 and 2 show the locations of the burial grounds to be considered within the 200 East and West Areas.

Burial Ground 218-W-3A began receiving waste in 1970. It consists of 61 trenches covering 50.3 acres. Waste stored or disposed of includes mixed, transuranic (TRU) waste, low-level waste (LLW), and retrievable waste. Examples of waste placed in this burial ground include ion-exchange resins and industrial waste (failed equipment, tanks, pumps, ovens, agitators, heaters, hoods, jumpers, vehicles, and accessories). The burial ground also stores spent fuel.

Burial Ground 218-W-3AE began receiving waste in 1981. It consists of 31 trenches covering 49.4 acres. Waste in this burial ground includes low-level and mixed waste. Examples of waste placed in this burial ground include rags, paper, rubber gloves, disposable supplies, broken tools, and industrial waste.

Burial Ground 218-W-4B began receiving waste in 1968. It consists of 13 trenches and 12 caissons covering 8.6 acres. The trenches contain mixed and retrievable TRU waste and were filled before 1980. Caisson Alpha 4 is believed to contain mixed waste.

Figure 1. 200 East Area Burial Grounds.

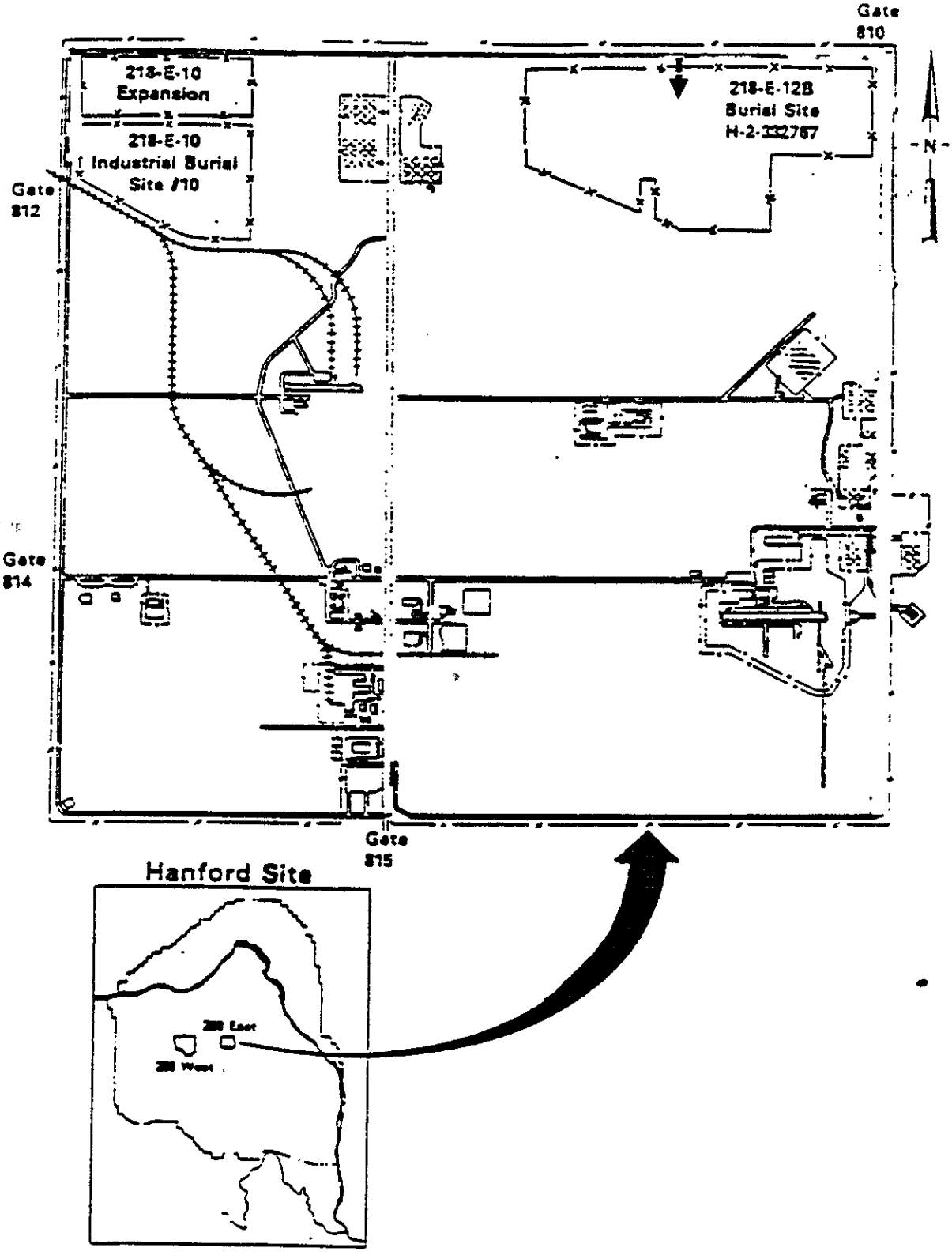
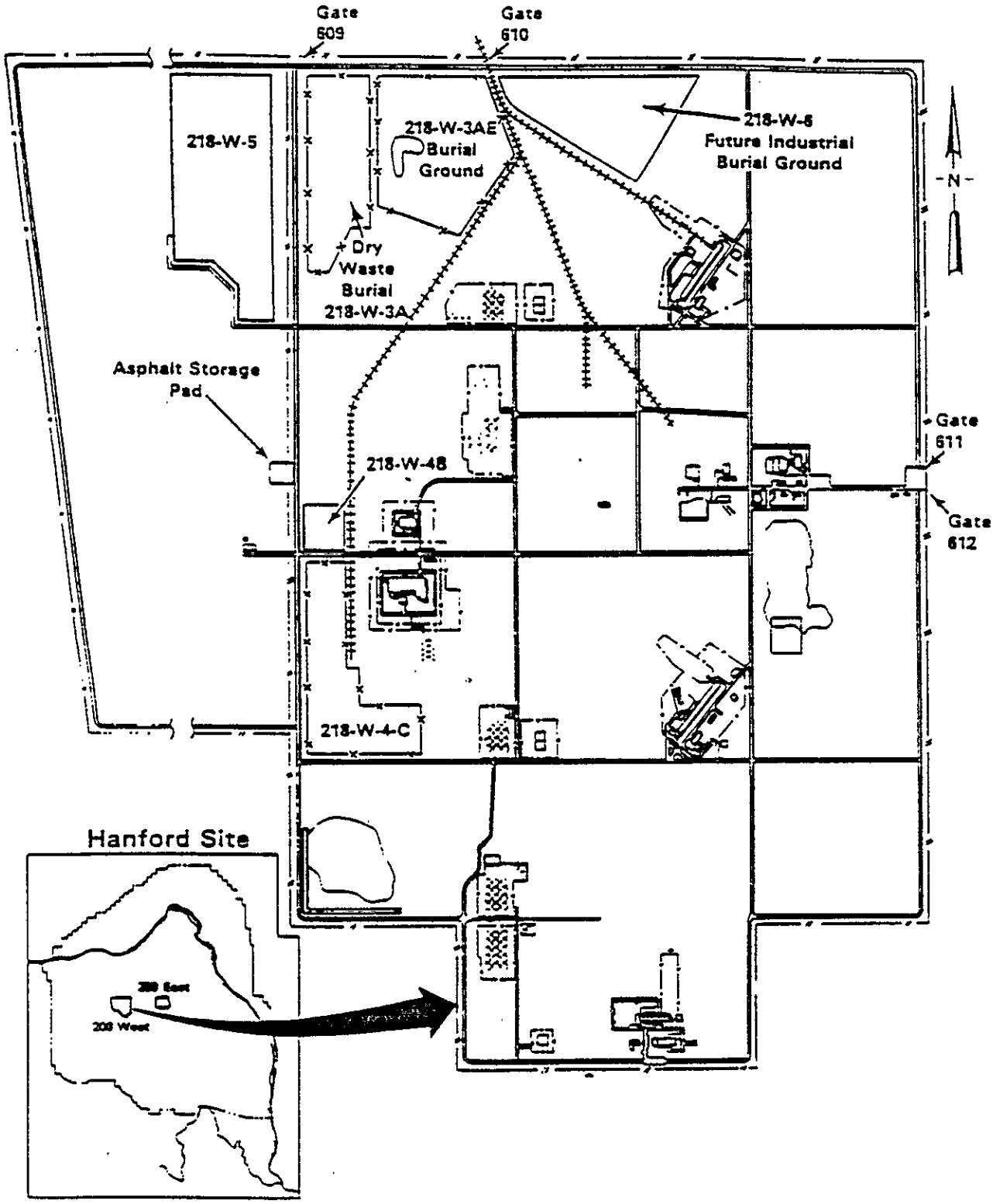


Figure 2. 200 West Area Burial Grounds.



Burial Ground 218-W-4C began receiving waste in 1978. It consists of 69 trenches covering 51.7 acres. Waste in this facility includes TRU, mixed, and LLW. Examples of waste placed in trenches include contaminated soil, decommissioned pumps, pressure vessels and hardware, and stored spent fuel. Some of the trenches are designed to be retrievable storage.

Burial Ground 218-W-5 began receiving waste in 1986. The facility consists of 35 trenches, with room for eventual expansion to 57 trenches, covering 84.0 acres. The trenches contain low-level mixed waste that includes lead bricks and shielding. Some LLW also was placed in this landfill.

Burial Ground 218-W-6 has not received any waste to date. When developed, this burial ground will consist of 35 trenches that cover approximately 44.5 acres.

Burial Ground 218-E-10 began receiving waste in 1960. It consists of 18 trenches covering 56.7 acres. Waste at this site was received from the Plutonium/Uranium Extraction Plant, B Plant, and N Reactor and includes low-level and low-level mixed waste such as dragoff waste, failed equipment, and industrial waste.

Burial Ground 218-E-12B began receiving waste in 1967. It consists of 94 trenches covering 173.1 acres. Areas are set aside for future expansion of this burial ground. Waste contained in this burial ground includes mixed waste, LLW, and TRU waste. Trench 94 contains U.S. Navy defueled submarine reactor compartments.

3.0 STATUS OF OPERATIONS

3.1 PAST PRACTICES

Solid waste, designated low-level, low-level mixed, TRU, or TRU mixed, was disposed of in shallow, unlined trenches in the LLBG beginning in 1960. The LLBG have accepted radioactive waste generated at various facilities on and off the Hanford Site. Most of the waste transported to the LLBG was generated on the Hanford Site.

Characteristics of the Hanford Site waste are highly variable and can include materials such as soil, rags, protective clothing, failed equipment, decontamination waste, and laboratory and chemical processing waste. Offsite generated waste also is highly variable in character and can include such waste as defueled nuclear reactors, laboratory waste, chemical processing waste, and various industrial wastes.

Two basic types of trenches have been used for disposal in the LLBG. These are V-trenches and industrial trenches. Modifications to these two basic types were used as necessary. The V-trenches normally were dug to a depth of 16 ft with the bottom ranging from 0 to 16 ft wide. Trench slopes ranged from 1H:1V to 1.5H:1V, where H=horizontal and V=vertical. Waste placed in these trenches for disposal was backfilled with a minimum of 8 ft of soil

on the day of receipt or as needed. A concrete and metal variation, a V-trench (a V-7 trench), was used for a short time from 1972 to 1973.

Industrial, or wide-bottom, trenches may have been up to 50 ft deep with the bottom ranging from 16 ft to over 100 ft wide. Trench slopes usually were 1.5H:1V to avoid sloughing of the trench walls. If vehicular traffic was required in the trench, the bottom of the trench was stabilized with several layers of crushed gravel. This layer also provided a base for stacking waste. A wide-bottom trench was routinely backfilled. Backfill consisted of soil to a minimum depth of 8 ft for disposed waste and 4 ft for retrievable stored waste.

Before 1970 no attempt was made to segregate the waste by type or level of radioactivity. Since 1970 solid waste designated or suspected to be TRU waste has been segregated from other radioactive waste and placed in retrievable storage units. Since 1985 steel drums containing radioactive organic liquid waste (mixed waste) also were placed in retrievable storage. Since November 23, 1987, mixed waste burial has been halted except for the disposal of mixed waste containers with a dose rate greater than 200 mrem/h at the container surface and special-case wastes (e.g., Shippingport reactor vessel). Waste with a dose rate of greater than 200 mrem/h requires the use of remote-handling techniques to keep the radiation exposure to workers as low as reasonably achievable (ALARA). All TRU waste, regardless of storage method, eventually will be retrieved.

For retrievable waste storage, special backfilling techniques were used. The retrievable waste was placed in a V-trench with a wide bottom. Before waste placement, fire-retardant plywood or an asphalt pad was laid on the bottom of the trench. Plywood also was placed between layers of waste and on top of the waste. After 1974, the waste and plywood were covered with a heavy plastic layer before the trench was backfilled. A small amount (estimated to be less than 5 lb) of remote-handled retrievable TRU waste with a dose rate of greater than 200 mrem/h at the container surface was stored in covered caissons. The caissons were used only for small quantities of remote-handled waste from laboratories. All caissons in the LLBG are located in Trench 14 of burial ground 218-W-4B.

Each burial ground may consist of trenches containing combinations of waste. For example, a trench containing low-level mixed waste may lie between a trench containing LLW and a trench containing retrievable TRU waste. Some trenches contain areas with LLW (i.e., disposed of) and other areas with retrievable stored waste. In these cases only the retrievable stored waste will be retrieved. An individual container may contain more than one type of waste (e.g., LLW and TRU waste packages in one barrel).

Trenches that received mixed waste and were backfilled before the effective date of mixed waste regulation are not subject to regulation as permitted treatment, storage, or disposal units under Washington Administrative Code (WAC) 173-303 (WAC 1989). However, because of the irregular distribution of these trenches within areas containing trenches that received waste after the effective date of regulation, both types of trenches will be closed under WAC 173-303 regulations to facilitate the design and construction of closure barriers.

The existing portions of the LLBG are exempt from the liner system requirements or alternate technologies requirements as provided for in WAC 173-303-806(4)(h)(ii)(A) (WAC 1989). The existing portion includes all filled and unfilled trenches constructed before November 23, 1987.

3.2 CURRENT AND FUTURE PRACTICES

The purpose of this section is to provide an overview of current and future operation of the LLBG. Based on onsite and offsite generator forecasts, the average amount of LLW to be disposed of annually in the LLBG is estimated to be approximately 550,000 ft^3. Mixed waste is estimated to make up 5% or less of the waste received by the LLBG. Based on recent generator forecasts, the total quantity of mixed waste accepted by the LLBG is expected to vary from 2,000 to 5,000 ft^3/yr into the foreseeable future. The forecast does not include special waste such as defueled submarine reactor compartments. The amount of mixed waste received by the LLBG is highly variable and may differ significantly from the forecasted amounts because of changes in the nature or level of activities on and off the Hanford Site. Waste forecasts are updated annually. As cleanup activities are initiated at the Hanford Site, the forecast could change significantly.

3.3 LOW-LEVEL BURIAL GROUND OPERATION

Before receipt of waste at the LLBG, the solid waste organization characterizes the waste and designates the waste according to WAC 173-303-070 (WAC 1989) and the *Hanford Site Radioactive Solid Waste Acceptance Criteria* (Stickney 1989). The generator is responsible for packaging the waste according to U.S. Department of Transportation (DOT) regulations for hazardous materials. The waste is shipped by the waste generator to the LLBG by train or truck. Once the shipment is accepted from the transporter, the LLBG personnel select an appropriate landfill disposal trench or storage facility, depending on the type of radioactivity, dangerous waste designation of the contents, and waste packaging.

The waste received by the LLBG is packaged in wooden boxes, steel drums, concrete burial vaults, or other approved burial containers. Mixed waste is received only in steel or concrete containers. Concrete dragoff boxes are commonly used for waste that exceeds 200 mrem/h. The dragoff boxes are transported to a trench by a flatbed railroad car and remotely skidded off into the trench. Waste types received at the LLBG are handled as summarized in the following paragraphs.

The LLW currently received at the LLBG is placed in V-shaped or industrial trenches. The waste routinely is covered with soil for permanent disposal. This method is used in both existing and future trenches for disposal of LLW.

Most mixed waste, other than the submarine reactor compartments in Burial Ground 218-E-12B, currently is not disposed of at the LLBG. Most mixed waste shipped to the LLBG currently is placed in storage buildings at the adjacent Central Waste Complex pending treatment in the Waste Receiving and

Processing (WRAP) Facility. Treatment at the WRAP Facility will allow the waste to be certified for disposal in *Resource Conservation and Recovery Act* (RCRA)-compliant facilities.

The Central Waste Complex, including the WRAP Facility, is closely related to the LLBG because the Central Waste Complex receives most waste before it is transferred to the LLBG after it is retrieved from the LLBG. The Central Waste Complex adjoins the west site of LLW management area.

Two types of mixed waste currently are being disposed of at the LLBG. This mixed waste includes remote-handled waste (with exposures of greater than 200 mrem/h at the container surface) and special waste. Special waste, as used here, includes unique waste that requires special handling or unusual waste such as decommissioned reactor vessels. Disposal of remote-handled or special waste in existing V-shaped or industrial trenches is allowed under the existing portion exemption [WAC 173-303-806(4)(h)(ii)(A)] (WAC 1989). Use of existing trenches will continue until the existing trenches are filled.

Ultimately, low-level mixed waste will be disposed of in Burial Grounds 218-W-5 and 218-W-6 in RCRA-compliant lined trenches with leachate collection systems, or disposed of using approved alternate technologies. The low-level landfill trenches planned for future use generally will be of a length and width similar to those of the existing trenches. Future low-level mixed waste landfills will be wider than the LLW trenches.

Transuranic waste and transuranic mixed waste currently are being accepted at the Central Waste Complex and the Transuranic Storage and Assay Facility for interim storage if the waste has been certified to comply with disposal-site waste acceptance criteria.

The TRU waste and TRU mixed waste stored in trenches since 1970 will be retrieved. If the waste is TRU or TRU mixed waste and cannot be transported without significant treatment, the waste will be processed for treatment through the WRAP Facility when it is completed. The TRU portion will be shipped to a national repository for disposal. The non-TRU mixed waste portion resulting from treatment at the WRAP Facility will be disposed of in the LLBG in RCRA-compliant facilities. The remote-handled waste (greater than 200 mrem/h at the container surface) retrieved from the alpha caisson may be shipped for processing to the Oak Ridge National Laboratory in Oak Ridge, Tennessee.

Retrieved low-level mixed waste and low-level organic liquid waste, stored since 1985, will be processed through the WRAP Facility and treated to allow for land disposal of the waste in RCRA-compliant facilities.

Records are available for waste placed in the LLBG since the burial grounds began operating in 1960. The detail associated with these records increases with time, particularly beginning in 1968. An account of radioactive waste disposed of or stored in the LLBG since 1968 is maintained on a continuing basis in the *Richland Solid Waste Information Management Systems* (Poremba 1990). This computer database lists the location of the waste container (using Hanford Site coordinates), the waste type, and the record number of the original shipping documents, a container code (definitions of the various container codes is contained in the database), the

volume of the waste container in cubic feet, and the weight of the container plus the waste in pounds. The last two categories include a list of dangerous constituents and the weight of each dangerous constituent in pounds. The most complete records for mixed waste have been maintained since 1986.

Waste acceptance procedures have changed since waste first was received at the LLBG and are different for mixed waste and other radioactive waste types. Currently solid low-level mixed waste in packages with a surface radiation dose of greater than the 200 mrem/h is disposed of at the LLBG. Research reactor fuels and TRU waste currently are stored at the LLBG. Small quantities of free organic liquids are stored at the LLBG pending the availability of a treatment facility. The practice of placing liquid mixed waste in the burial grounds was discontinued November 23, 1987. No high-level waste, bulk mixed waste, or nonradioactive dangerous waste is disposed of at the LLBG.

Most low-level mixed waste with a surface radiation dose of less than 200 mrem/h currently is stored in the Central Waste Complex and will be disposed of at the LLBG when lined landfills or alternate technologies are available. Special mixed waste types, such as the Shippingport reactor, will be disposed of in the existing portion of the LLBG until alternate disposal methods are developed.

Only a relatively small fraction of the waste placed in the LLBG is classified as mixed waste. Dangerous constituents of this waste are cocontaminants of the radioactive waste. Mixed waste disposed of or stored at the LLBG includes waste designated as dangerous waste and extremely hazardous waste under Washington State Department of Ecology (Ecology) regulations. Such waste also is categorized as toxic, extraction procedure toxic, and corrosive under RCRA regulations and as toxic under WAC 173-303 (WAC 1989).

Mixed waste disposed of or stored at the LLBG is packaged in a system of multiple barriers selected and specifically engineered to isolate the waste content from man and the environment. The waste is confined in package systems that may include several plastic, metal, and glass containers as well as additional barriers to the environment or to make the waste more compatible with other barrier materials. The system is designed for 20-yr retrieval.

As noted previously, waste characteristics information is based on records developed by the generator, not by laboratory analysis of samples obtained from the LLBG. Representative sampling would be difficult to achieve at the LLBG. In addition, the risk of radioactive exposure to sampling personnel would violate objectives to keep such exposure ALARA.

4.0 SOURCE TERM

4.1 IDENTIFICATION OF INVENTORY AT RISK

Mixed waste accepted at the LLBG before November 23, 1987, generally falls into one of the following categories:

- Low-level beryllium alloy waste
- Low-level perchloroethylene waste
- Low-level mercury
- Lead waste and lead from decommissioned systems
- Low-level, miscellaneous lab-pack chemicals
- Radioactive scintillation liquids
- Liquid mixed waste
- Primary and secondary quench salt bath sludge.

4.1.1 Low-Level Beryllium Alloy Waste

This waste previously was generated at the Hanford Site's 300 Area. The waste was generated during a machining operation on the 95% zirconium/ 5% beryllium alloy brass rings on the ends of uranium reactor fuel rods for N Reactor. The machine cuttings were collected, mixed with concrete, packaged in DOT-approved 55-gal steel drums, and transported to the LLBG for storage.

4.1.2 Low-Level Perchloroethylene Waste

This waste was generated at the Hanford Site's 300 Area and used as a solvent in certain operations involved in the fabrication of uranium reactor fuel. When the perchloroethylene lost its effectiveness, as determined by process specifications, it was removed from service. The spent perchloroethylene was solidified in DOT-approved 30-gal drums with an emulsifying agent and a gypsum solidification product. The 30-gal drums were packaged in 55-gal steel drums and transported to the LLBG for storage.

4.1.3 Low-Level Mercury

Small quantities are generated as waste at the Hanford Site and various U.S. Department of Energy (DOE) facilities. The primary source of this waste is process control equipment such as manometers and light bulbs containing mercury. Low-level mercury waste is sealed in plastic jars or amalgamated with zinc, entombed in concrete, placed in 55-gal steel drums, and transported to the LLBG for storage or disposal.

4.1.4 Lead Waste and Lead From Decommissioned Systems

This waste was received from the Hanford Site and various DOE facilities. Lead used in radioactive-material shipping containers and containment shields and lead from decommissioned systems are transported to the LLBG or the Central Waste Complex for storage or disposal.

4.1.5 Low-Level, Miscellaneous Lab-Pack Chemicals

These chemicals were generated as waste at the Hanford Site and various other DOE facilities. Small containers (less than 1 gal) of solid miscellaneous low-level radioactive waste, which may have contained dangerous constituents, were overpacked in 55-gal steel drums and transported to the LLBG for storage. The practice of storing this waste in retrievable storage units was discontinued in November 1987.

4.1.6 Radioactive Scintillation Liquid

Radioactive scintillation liquid was generated as waste at the Hanford Site facilities and other offsite facilities. Scintillation liquid consisted primarily of xylene, toluene, or a mixture of these two chemicals. The scintillation liquid, known as a scintillation cocktail, was used as a carrier fluid for liquid scintillation counting--a gamma-scan analysis technique primarily used to measure tritium and ^{14}Co concentrations. The spent scintillation liquid was sealed in small (approximately 20-mm) glass vials; up to 2,000 of these glass vials were overpacked in 55-gal galvanized or aluminized steel drums, together with combustible organic material such as CONWED* pads, and the drums were transported to retrievable storage in the LLBG. The practice of storing this waste in retrievable storage units was discontinued in November 1987.

4.1.7 Liquid Mixed Waste

Liquid mixed waste was generated at the Hanford Site and various other DOE facilities. This waste consisted primarily of solvents and reagents used in research and development projects. The organic liquids were sealed in small (up to 15-gal) metal or plastic containers that contained absorbent. These small containers were overpacked in 55-gal steel drums and transported to retrievable storage in the LLBG. The practice of storing this waste in retrievable storage units was discontinued in November 1987.

4.1.8 Primary and Secondary Quench Salt Bath Sludge

Before November 1987, primary and secondary quench salt bath sludges from the cleaning of nuclear fuel cladding were placed in retrievable storage units.

4.1.9 Other Wastes

Since November 23, 1987, the LLBG waste acceptance procedures do not allow free liquids in the disposal units. The generators must sign a certification that no free liquids are present in their waste streams. Free liquid is liquid that is not sorbed into a host material and thus could spill or drain from its container.

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*CONWED is a trademark of CONWED Corporation.

Under current operating conditions, mixed waste stored or disposed of at the LLBG is packaged in double containment or otherwise packaged to ensure isolation from the environment for 20 yr.

Radioactive waste that is reactive, pyrophoric, incompatible with other waste in the same containers, or explosive is not accepted for disposal or storage at the Hanford Site unless the waste has been converted to a safe form. Mixed waste that is corrosive is not accepted for storage or disposal unless internal container protection has been provided.

4.2 IDENTIFICATION AND CHARACTERIZATION OF POTENTIAL SOURCE TERM

4.2.1 Radioactive Waste

The paragraphs that follow describe the radiological consequences of the upset conditions identified above.

4.2.1.1 Trench Breach. A trench breach caused by the intrusion of an animal or plant could result in the uptake of contamination by the plant or animal. However, the migration of this contamination via transport by the plant or animal would not result in measurable dose consequences to any member of the offsite public. The Hanford Site environmental monitoring program monitors for this type of environmental spread of contamination. Subsidence or collapse of a burial trench may be caused by voids generated by container deterioration, equipment deterioration, or improper filling. Although no accurate historical records exist, instances of trench settling are known to have occurred. These occurrences have varied from relatively slight settling to a total collapse. Collapse could result in the uncovering of waste material; however, because the definition of an upset is the loss of one material confinement/containment barrier, the burial containers would be considered intact and surface contamination would be the only material available for airborne dispersal. The levels of radioactivity available to become airborne from the surface of the buried waste are not high enough to produce a measurable dose at the site boundary. At the time of the LLBG Safety Analysis Report (SAR) (1984) no release of contamination caused by subsidence or collapse had been recorded.

4.2.1.2 Local Flooding. Onsite flooding in an area of exposed waste could result in the spread of surface contamination. If the flooding is severe enough, a small amount of contamination would be spread to the soil column and possibly outside the trench boundary. Assuming this small amount of contamination could reach the water table and be transported offsite, the offsite dose would be insignificant. In accordance with an agreement signed by Ecology and the DOE Field Office, Richland, in 1986, a groundwater monitoring system consisting of 35 wells was installed around the LLBG. This system was included in the DOE Field Office, Richland, Part A, Dangerous Waste Permit Application, and was identified as being in use for radioactive waste with hazardous constituents. The groundwater monitoring program for the LLBG is described in Chapter 5.0 of the DOE Field Office, Richland, Low-level Burial Grounds Dangerous Waste Permit Application, Part B. This program is intended to comply with Ecology regulations for the operation of dangerous waste facilities.

4.2.1.3 Container Failure/Breach. The failure of a container of buried waste could result in the release of waste material to the trench. With the trench intact, there is no release pathway for solids that may escape the container; if the waste is liquid form there is the potential for contamination spread to the soil column, and for volatile liquids there is the possibility that vapor could migrate to the surface. The failure/breach of a container during placement or retrieval operations could result in an airborne and/or subsurface release pathway. A review of current burial ground practices and the LLBG SAR and Addendums reveals that the most severe offsite consequences from an upset condition would be caused by a box spill during contact-handled transuranic waste retrieval activities within Burial Grounds 218-W-4B (LLBG SAR, Addendum 6).

4.2.1.4 Box Spill Accident. The upset condition evaluated for the LLBG is the rupture of a box that is being lifted to the nondestructive analysis area at the side of the trench. The box is assumed to break open and spill its contents to the asphalt pad. The exact height from the maximum lift height is not known, but will be assumed to be 16 ft (488 cm) to the asphalt pad. From existing burial ground records, the box with the largest TRU content is a metal box that contains 494 g of TRU. It is assumed that this box ruptures and spills its contents to the asphalt pad. Although the waste form anticipated is not likely to contain much powder, a conservative assumption used here is that 10% of the TRU in the box can behave as powder and 50% of the contents of the box is released. From U.S. Nuclear Regulatory Commission (NRC) Nuclear Regulation 1320 (NRC) a method applicable to the spill of powders is described. The respirable fraction airborne is given by

$$F = 10^{-8} H^2/P$$

where

H = spill height (cm) and
P = powder bulk density (g/cm^3)

$$F = \frac{494\ g \times 0.1\ FP \times 0.5\ FR \times (488\ cm)^2 \times 10^{-8}}{1 g/cm^3}$$

$$= 5.9 \times 10^{-2}\ g \text{ or } 5.5 \times 10^{-3}\ (PE\ Ci)^*$$

where

FP = fraction powder
FR = fraction released.

*Plutonium Equivalent Curies (Ref. 13).

From the Pacific Northwest Laboratory dose calculation tables the release of this amount of material at ground level from Burial Ground 218-W-4B will result in the following offsite consequences:

Computer Codes	Effective Dose Equivalent
CAP-88 (Beres 1990)	0.03 mrem
GENII (Napier et al. 1988)	0.02 mrem

Neither of these values exceeds the 0.1 mrem limit that would require a FEMP.

4.3 NONRADIOACTIVE HAZARDOUS WASTE

Because it is assumed that there is no nonradioactive hazardous material contamination on the outside of the containers, neither the trench breach or local flooding will result in the release of hazardous material. Container failure/breach could result in the loss of nonradioactive hazardous waste. The failure of a container of buried waste could result in the release of a small amount of material into the trench area. Because of the lack of a dispersion mechanism, released solids would be expected to remain in the immediate vicinity of the container within the trench and thus do not represent an effluent pathway. Although waste packaging requirements for liquids have varied over the years, they were all intended to restrict the amount of free-standing liquid within each container. It is unlikely that a container failure could result in the release beyond the trench boundary of a reportable quantity of hazardous liquid without postulating an additional failure mechanism, which is outside the definition of an upset condition. Vapor resulting from liquids present with a failed container would mostly be trapped within the confines of the trench and burial overpack. It is not likely that, even for the most volatile liquids, a reportable quantity of material in vapor form could reach the surface from the failure of a single container.

A container failure/breach during trench placement or retrieval operations represents the upset condition with the greatest potential for releasing a significant quantity of nonradioactive hazardous material. A complete listing of the hazardous materials estimated to exist within the LLBG and their quantities is contained in the *Low-Level Burial Grounds Dangerous Waste Permit Application, Part A.* The materials of most concern as identified from the records are as follows:

Inorganics	Organics*
asbestos	antifreeze
beryllium	stripcoat
cadmium	trichloroethane
caustic (NaOH)*	other solvents
copper	polychlorinated biphenyl
lead	tributyl phosphate
sodium	carbon tetrachloride
lithium	hydraulic fluid
zirconium	oils
nitric acid*	methylene chloride
other corrosives*	trichloromethane

*indicates possible liquid form of waste.

The solid materials are most probably in sheet or block form that would not be readily dispensable. Solids that are spilled during placement or retrieval operations are assumed to be recoverable and are therefore not lost to the environment. It is also assumed that a container failure or breach resulting in a spill of liquid will be contained within the trench and be retained on the asphalt pad or the soil column and thus be recoverable. Liquid lost to the environment will be in the form of vapor.

Since current burial ground practices prohibit the placement of mixed waste, the upset condition resulting in the maximum amount of vapor released would be the breach of a sealed drum during a retrieval operation in which the liquid and vapor had reached an equilibrium. An estimate of the maximum quantity released can be made. A peak equilibrium concentration that could be expected in a closed volume is 10 mg/m^3 (EPA 1990a). The maximum waste volume in a waste drum is 55 gal or 0.21 m^3. At 10 mg/m^3 there is 2.08 mg in the gas space. For certain volatile organic compounds, such as methylene chloride or trichloromethane, the maximum quantity of vapor present that could be released would be greater than 2 mg.

If a sufficient quantity of volatile organic compound was present inside a waste drum and had not been adsorbed by over-packing material, the void volume of the drum would come into equilibrium with the free liquid. The concentration of vapor in the void volume would depend on the vapor pressure of the particular compound. For example, trichloromethane at 79 °F has a vapor pressure of 200 torr. By conservatively assuming the ideal gas law and an atmospheric pressure of one atmosphere, the gas inside the drum is

$$200 \text{ torr}/760 \text{ torr} = 0.26 \text{ volume fraction trichloromethane vapor.}$$

With a maximum void volume of a 55-gal drum of 0.21m^3, this can represent

$$0.21 \text{ m}^3 \ (1{,}000 \text{ L/m}^3)(0.26 \text{ vol frac}) = 55 \text{ L of pure } CHCl_3 \text{ vapor.}$$

The gas density of trichloromethane corrected to 79 °C is

$$\frac{119.36 \text{ g/g-mol}}{22.4 \text{ L/g-mol}} \ (460/460 + 79) = 4.55 \text{ g/L.}$$

Total trichloromethane present as vapor is

$$(4.55 \text{ g/L})(55 \text{ L}) = 250 \text{ g.}$$

Regulation 40 Code of Federal Regulations (CFR) 302.4 (EPA 1990b) indicates that the *Comprehensive Environmental Response Compensation and Liability Act of 1980* statutory reportable quantity (RQ) for trichloromethane (chloroform) is 5,000 lb (2270 Kg). Therefore, the 250 g released as vapor do not represent a RQ. A similar calculation for trichloro-ethane based on the same assumptions yields a release of 182 g, which is well below the RQ limit of 454 g (1 lb). Similar calculations can be performed for the other liquids of interest to show that the available quantity in vapor form does not exceed the reportable quantity specified in 40 CFR 302.4. The following list presents some of the more volatile or most expected liquids to be found in the drums scheduled for retrieval. It can be seen that the amount that could be reasonably expected to be released from a single 55-gal drum as a result of an upset condition could not exceed the reportable quantity.

Hazardous Substance	Final RQ (Kg)*
Sodium Hydroxide	454
Nitric Acid	454
Trichloroethane	0.454
Carbon Tetrachloride	2270
Methylene Chloride	454
Trichloromethane	2270
Benzene	454
Toluene	454
Xylene	454

*Taken from 40 CFR 302.4, Table 302.4.

5.0 UPSET-OPERATING CONDITIONS

In general, normal burial ground activities consist of placing waste in burial trenches, burial of filled trench portions, and retrieval of wastes for processing by other facilities. None of the normal process activities associated with the LLBG results in an effluent stream to the environment. Therefore, upset conditions represent the sole mechanism for potential releases to the environment.

To identify upset conditions applicable to this FEMP determination the LLBG SAR (RHO-CD-1554, Rev. 1, April 1984) and Addenda 1, 3, 2, 4, 5, and 6 were reviewed. The SAR addenda state that any event having a probability in the range of 1 to 10 x 10^{-2} is to be considered "anticipated." It further defines such an event as "An off-normal condition that individually may be expected to occur once or more during plant lifetime." The Westinghouse Hanford Company (Westinghouse Hanford) (1991) document defines an upset condition as "an unusual plant operating condition where one material confinement/containment barrier or engineered control has failed." By combining SAR-defined events within the probability range of 1 to 10 x 10^{-2} with the Westinghouse Hanford (1991) definition of an upset condition, we can determine the upsets to be considered for this determination.

Upset conditions meeting these criteria include breach of trench, container failure or breach, and local flooding (river flooding is not within the probability range).

Each of the identified upset conditions have different consequences within the bounds of each of the burial ground activity areas (storage, retrieval, placement/burial). A breach of trench upset condition would apply only to wastes in storage that were already buried. A trench breach can occur in one of two ways: through subsidence or via penetration by animals or plants. A container failure/breach can take place during storage, retrieval, or placement/burial. Container failures or breaches within the proper probability range include corrosion, heavy equipment impact, and spill. Corrosion is a factor for waste packages that are buried or being retrieved, heavy equipment impacts are likely to occur during burial or retrieval activities, and a spill is likely during placement or retrieval. Local flooding is a credible upset caused by heavy rains and runoff. Local flooding would have minimal impact on wastes that were already buried; wastes exposed for retrieval or placement would be most affected.

6.0 SUMMARY

As stated previously, none of the normal burial ground process activities result in an effluent stream to the environment. Therefore, upset conditions represent the sole mechanism for release to the environment to be considered under a FEMP determination. Events defined by the LLBG SAR as anticipated and falling into the probability range of 1 to 10 x 10^{-02} were considered and compared to the definition of upset condition contained in Westinghouse Hanford (1991). Three general upset conditions were identified as having the potential to result in a release of hazardous waste to the environment. The three general upset conditions were trench breach, local flooding, and container failure/breach.

The radiological consequences due to trench breach and local flooding were considered to be insignificant. Considering inventory available for release and potential impact, the upper level bounding upset for container failure/breach would be during TRU retrieval operations. From the LLBG SAR the most severe container breach upset would be caused by a box spill. According to the records the box containing the largest inventory that is scheduled for retrieval contains 494 g of TRU. The SAR calculations indicate that 5.9 x 10^{-02} g (5.5 x 10^{-03} PECi) would be released. This results in a maximum exposure to a member of the general public offsite of 0.03 mrem effective dose equivalent as calculated by CAP-88 (Beres 1990) and an exposure of 0.02 mrem as calculated by GENII (Napier et al. 1988). Therefore, the offsite dose resulting from this release would be below the 0.1 mrem/yr specified for a FEMP.

It is assumed that there is no external removable nonradioactive contamination on the waste containers; therefore, the trench breach and local flooding upsets do not result in the release of nonradioactive hazardous materials. The container failure/breach upset during retrieval operations provides a pathway for the release of the greatest quantity of material. The

greatest quantities would be releases in the form of liquid vapor. Calculations suggest that no reportable quantity of any of the identified materials could be released in the form of liquid vapor.

As a result of this analysis it is concluded that no FEMP is required for the LLBG.

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

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Attachment 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY Low-Level Burial Grounds (LLBG) DISCHARGE POINT: Burial Grounds

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/Chemical Form	Quantity (Curies)	Quantity Released	Projected (mrem/yr)
1.	(Worst case upset release calculated for TRU)				
2.	TRU	Powder	5.5 E-03 PE Ci	5.9 E-02 g	.03 (CAP-88)
Total					

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated Material	Quantity (lbs)	Quantity Released	Reportable Quantity (lbs)	% of RQ Quantity/Year
1.	(See listing contained in Part A Permit Application-sample calculation performed for trichloroethane and trichloroethane)				
2.	trichloroethane	unknown	.55 lbs	5,000	0.01%
3.	trichloroethane	unknown	.40 lbs	1	40.00%

Identification of Reference Material

See listing of references in attached supporting material

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required ___ FEMP is not required X

EVALUATOR Robert E. Bell * DATE 5/8/91

MANAGER, ENVIRONMENTAL J. M. Nicholas DATE 5/20/91

FACILITY MANAGER D. D. Hay DATE 5/13/91

Attachment 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

Identification of Reference Material

See listing of references in attached supporting material

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Robert E. Bell * DATE 5/8/91

MANAGER, ENVIRONMENTAL J. M. Nickels DATE 5/20/91

FACILITY MANAGER D. E. Hey DATE 5/13/91

Attachment 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 213-W DISCHARGE POINT: 296-W-03

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/Chemical Form	Quantity (Curies)	Quantity Released	Projected (mrem/yr)
1.	$^{90}Sr/^{90}Y$	Solid contam.	10	1.5 E-03 μCi	6.6 E-11
2.	$^{137}Cs/^{137}Ba$	Solid contam.	9	1.3 E-03 μCi	3.1 E-11
3.	^{60}Co	Solid contam.	4.8	7.0 E-04 μCi	2.0 E-11
4.	^{54}Mn	Solid contam.	0.4	7.5 E-05 μCi	1.2 E-10
Total					

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated Material	Quantity (lbs)	Quantity Released	Reportable Quantity (lbs)	% of RQ Quantity/Year
1.	None				

Identification of Reference Material

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Robert E Bolton * DATE 5/8/91

MANAGER, ENVIRONMENTAL Jon Zulauf DATE 5/20/91

FACILITY MANAGER D E Hay DATE 5/13/91

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PART 14

TANK FARM FACILITIES

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

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CONTENTS

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LIST OF TERMS

ACGIH	American Conference of Governmental Industrial Hygienists
ACV	administrative control values
ALARA	as low as reasonably achievable
APCA	Benton-Franklin-Walla Walla Counties Air Pollution Control Authority
$B:PO_4$	bismuth phosphate
BACT	best airborne control technology
BAT	best available technology
BPT	best practical control technology
CAM	continuous air monitor
CEM	Continuous Emission Monitoring
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	Code of Federal Regulations
CIS	Contents Inventory Sheet
CY	calendar year
DCG	derived concentration guides
DCRT	double-contained receiver tanks
DF	decontamination factor
DOE	U.S. Depart of Energy
DOE-RL	U.S. Department of Energy - Richland Operations Office
DOT	U.S. Department of Transportation
DST	double-shell tank
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
EDTA	ethylenediametetraacetic acid
EHW	Extremely hazardous waste
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Agency
FEMP	facility effluent monitoring plan
HEDTA	N-(hydroxyethyl) - ethylenediaminetriacetate acid
HEPA	high-efficiency particulate air
HPT	health physics technician
HVAC	heating, ventilation and air conditioning
ICRP	International Commission on Radiation Protection
ID	inner diameter
II	interim isolated
IS	interim stabilized
MDL	maximum detectable limit
NBS	National Bureau of Standards
NCAW	neutralized current acid waste
ND	not detected
NESHAP	"National Emission Standards for Hazardous Air Pollutants"
NIST	National Institute of Standards Technology
NPDES	National Pollution Discharge Elimination System
NPH	normal paraffin hydrocarbon
OD	outer diameter
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PI	Partially interium isolated

LIST OF TERMS (Cont'd)

POTW	publicly owned treatment works
PPMW	parts per million by weight
PSD	Prevention of Significant Deterioration (permit)
PUREX	Plutonium, Uranium Extraction
RCG	radioactivity concentration guides
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	reduction oxidation
RQ	reportable quantity
RTR	real-time radiography
SAR	safety analysis report
SARA	*Superfund Amendments and Reauthorization Act of 1986*
SPCC	spill prevention control and countermeasure
SST	single-shell tank
TBP	tributyl phosphate
TCLP	toxic characteristic leach procedure
TRAC	Truck radioactive conponents (computer code)
TRU	transuranic
TRUSAF	Transuranic Waste Storage and Assay Facility
TWA	Transuranic Waste Assayer
WAC	Washington Administrative Code
WESF	Waste Encapsulation and Storage Facility
WF	weight factor
wg	water gauge
Westinghouse Hanford	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Plant

TANK FARMS FACILITIES FACILITY EFFLUENT MONITORING PLAN DETERMINATION

1.0 INTRODUCTION

This report presents the material required for the facility effluent monitoring plan (FEMP) for the Tank Farm Facility. Information discussed in the first four sections of *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* (WHC 1991) is included in this document. This includes introductory material; regulations, standards, or references from which facility description or effluent information is obtained; information on regulations and standards applicable to effluent releases and monitoring; and information that was prepared for the FEMP determination form for the Tank Farm Facility. The FEMP determination form for the Tank Farm Facility contains facility descriptions, process descriptions, identification and characterization of potential source terms, description of effluent paths, and determination of FEMP requirements for the following facilities:

- Double-shell waste tanks
- Single-shell waste tanks
- The 204-AR Unloading Facility
- The 244-CR Vault
- Double-contained receiver tanks.

The information from the FEMP determination form has been expanded and made more complete in some areas.

The Tank Farm Facility is located in the 200 East and West Areas of the Hanford Site in south central Washington State. The 200 Areas are in the approximate center of the site on a plateau about 7 mi from the Columbia River.

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2.0 FACILITY DESCRIPTION/STATUS OF OEPRATION

2.1 DOUBLE-SHELL WASTE TANKS

2.1.1 Facility Description

Double-shell tanks (DST) covered in this FEMP determination are listed in Table 2-1. The DSTs discussed are of two distinctly different types.

The first type consists of 1.0- to 1.2-M-gal DSTs designed for long-term storage (up to 50 yr) of high-activity mixed waste. For efficiency during construction and operation, these tanks were grouped in six tanks farms.

At the Hanford Site, all buildings, tanks, and other engineered structures are given individual alphanumeric designations, e.g., 241-SY-103. The 241 indicates that the structure is associated with a tank farm. The SY indicates that the tank is located in the SY Tank Farm. The 103 is the individual tank number within the SY Tank Farm. The DSTs in each tank farm generally are numbered starting with 101.

The tank farms contain 24 1.2-M-gal nonaging DSTs and 4 1.0-M-gal aging waste DSTs. Figure 2-1 shows the locations of the DSTs on the Hanford Site. The 241-SY Tank Farm is located in the west-central portion of the 200 West Area and consists of three tanks. The five other DST farms are located in the east-central part of the 200 East Area. The 241-AY and 241-AZ Tank Farms contain two tanks each; the 241-AW Tank Farm contains six tanks; the 241-AN Tank Farm contains seven tanks; and the 241-AP Tank Farm contains eight tanks.

The second type of tank is a smaller, 800- to 45,000-gal tank used primarily for lag storage of waste before transfer to the larger tanks or to other facilities. These smaller tanks are called double-contained receiver tanks (DCRTs) and are also discussed in this document.

The DSTs were fabricated as three concentric tanks. The free standing primary tank contains the waste material. The primary tank is 75 ft in diameter and 46 ft 9 in. high at the crown. The primary tank sits on a concrete insulating pad. The secondary tank, 5 ft larger in diameter than the primary tank, creates a surrounding space called the annulus. The secondary tank sits on a concrete structural pad. The completely enclosed annulus serves as a containment barrier if the primary tank should leak. The annulus is ventilated and continually monitored for evidence of primary tank leakage. The third tank is a concrete shell that encloses the sides of both primary and secondary tanks for additional containment, radiation shielding, and structural support. Figure 2-2 shows a cross section of a typical DST.

This FEMP determination also covers ancillary equipment, such as transfer lines betwen tank farms and/or DCRTs, associated valve pits, diversion boxes, and tank farm piping.

Table 2-1. Double-Shell Tank List.

Tank number	Location	Operation date
1.2 Mgal nonaging DSTs		
241-AN-101	200 East Area	09/81
241-AN-102	200 East Area	09/81
241-AN-103	200 East Area	09/81
241-AN-104	200 East Area	09/81
241-AN-105	200 East Area	09/81
241-AN-106	200 East Area	09/81
241-AN-107	200 East Area	09/81
241-AP-101	200 East Area	10/86
241-AP-102	200 East Area	10/86
241-AP-103	200 East Area	10/86
241-AP-104	200 East Area	10/86
241-AP-105	200 East Area	10/86
241-AP-106	200 East Area	10/86
241-AP-107	200 East Area	10/86
241-AP-108	200 East Area	10/86
241-AW-101	200 East Area	08/80
241-AW-102	200 East Area	08/80
241-AW-103	200 East Area	08/80
241-AW-104	200 East Area	08/80
241-AW-105	200 East Area	08/80
241-AW-106	200 East Area	08/80
241-SY-101	200 West Area	04/77
241-SY-102	200 West Area	04/77
241-SY-103	200 West Area	04/77
1.0 Mgal aging waste DSTs		
241-AY-101	200 East Area	04/71
241-AY-102	200 East Area	04/76[a]
241-AZ-101	200 East Area	11/76
241-AZ-102	200 East Area	11/76

[a]Estimated date the tank became operational.

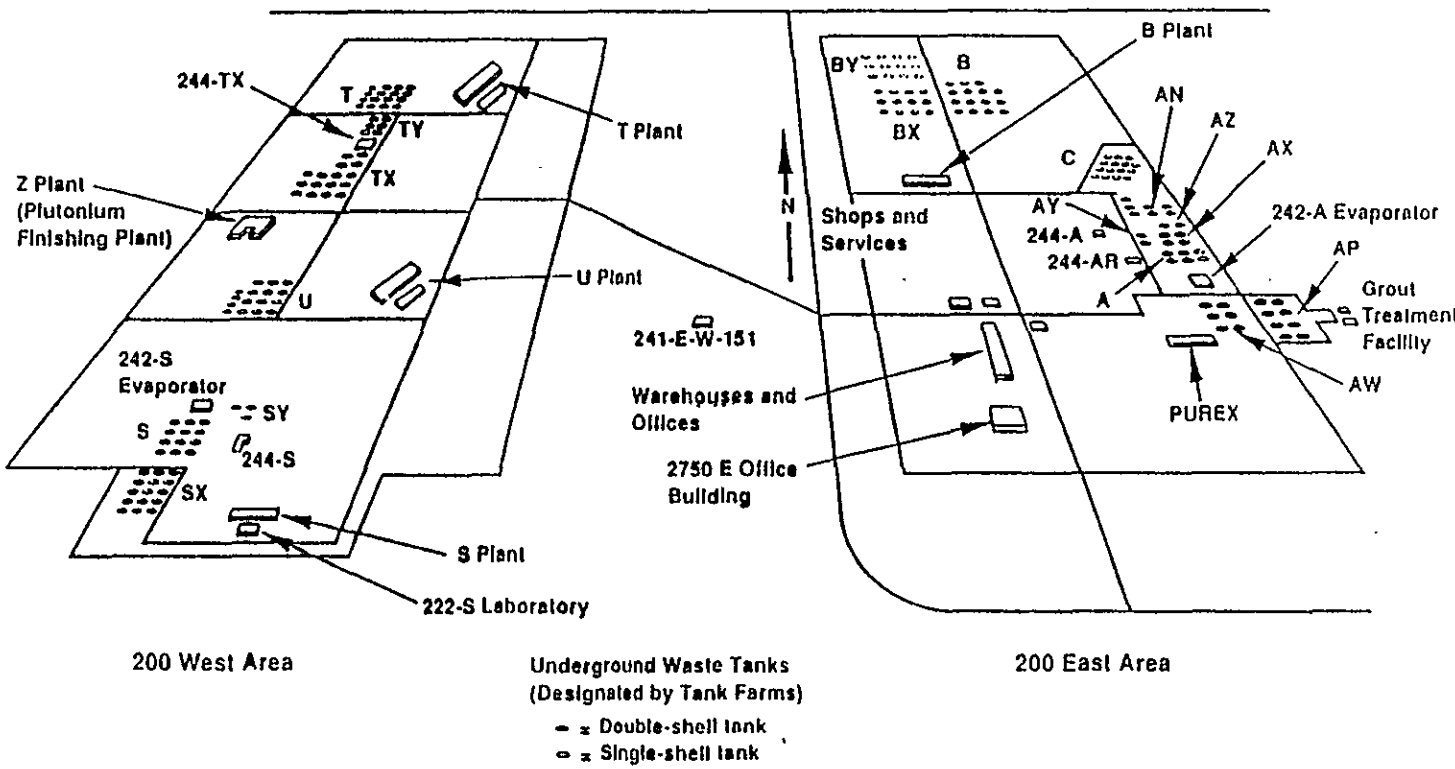


Figure 2-1. Double-Shell Tank Locations.

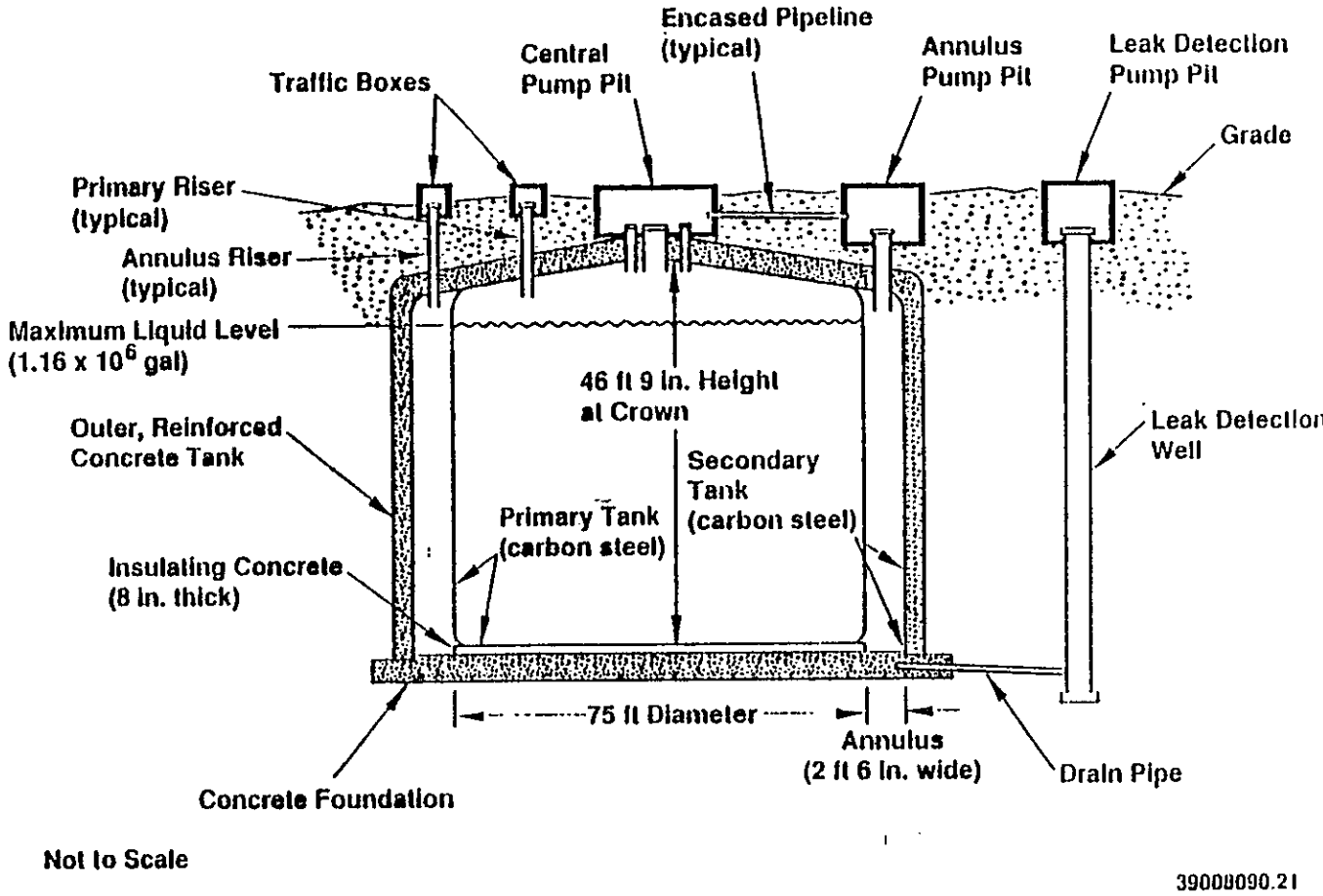


Figure 2-2. Typical Double-Shell Tank Cross Section.

2.1.2 Process Description

Waste stored in the DST farms includes waste from the following:

- Plutonium/Uranium Extraction (PUREX) Plant
- Plutonium Finishing Plant
- B Plant
- T Plant
- 222-S Laboratory
- 100 Areas
- 300 Areas
- 400 Areas
- Single-Shell Tanks.

A maximum of 28,000,000 gal of waste can be stored in the 28 DSTs in the 6 tank farms. No offsite waste is accepted for storage in the DST System.

Tables 2-2 and 2-3 list the types of waste stored in nonaging and aging tanks.

Waste from waste streams is stored in different tanks according to composition, degree of radioactivity, or source location. Some waste streams are combined in one DST, particularly when the stream volume and the potential for chemical interaction are small.

Generally, waste from the 100, 300, and 400 Areas is transported to the 200 East Area in railroad tank cars. The waste enters the DST System at the 204-AR waste unloading station, located north of the PUREX Plant. The 204-AR Building is also equipped to receive waste shipped by truck.

Generally, waste characterization of the DSTs is based on generator knowledge and review of generator records. Limited analyses have been performed on the waste, but most of these analyses were not performed using EPA protocols. Some waste contained in DSTs has not been analyzed.

The waste stored in the DSTs is a mixed waste containing both radioactive and hazardous chemical components as defined by the *Atomic Energy Act of 1954* and the *Resource Conservation and Recovery Act of 1976* (RCRA). The DST waste consists primarily of sodium hydroxide, sodium salts of nitrate, nitrite, carbonate, aluminate, phosphate, and hydrous oxides of iron and manganese. The radioactive part of the mixed waste includes various types and concentrations of radioactive constituents including high-level, transuranic, and low-level waste. These radioactive components consist primarily of fission products (e.g., ^{90}Sr, ^{137}Cs, and ^{129}I) and actinide elements (e.g., uranium, americium, plutonium, and neptunium).

Table 2-2. Tank Number and Type of Waste Stored in Million-Gallon Nonaging Double-Shell Tanks. (2 sheets)

Tank number	Waste stream source	Type of waste stored in tank
241-AN-101	244-BX	Single-shell tank saltwell waste
241-AN-102	B Plant	Complexed concentrate waste (waste encapsulation)
241-AN-103	242-A Evaporator	Double-shell slurry waste
241-AN-104	242-A Evaporator	Double-shell slurry feed waste
241-AN-105	PUREX	Neutralized cladding removal waste
241-AN-106	100 Area	Concentrate phosphate waste
241-AN-107	B Plant	Complexed concentrate waste (waste encapsulation)
241-AP-101	241-AP-103/G7	Ammonia scrubber feed (PUREX)
241-AP-102	100 Area	Phosphate and sulfate waste
241-AP-103	PUREX	Ammonia scrubber feed
241-AP-104	100 Area	Phosphate and sulfate waste
241-AP-105	241-AW-106/241-AP-106	Double-shell slurry feed and noncomplexed (242-A Evaporator) waste
241-AP-106	241-AY-102/241-AW-106	Double-shell slurry feed and noncomplexed (242-A Evaporator) waste
241-AP-107	PUREX	Process distillate discharge
241-AP-108	PUREX	Process distillate discharge
241-AW-101	Single-Shell tanks	Dilute noncomplexed waste Single-shell tank saltwell waste
241-AW-102	244-A/A-350 catch tank	Evaporator feed tank, double-shell slurry feed (242-A Evaporator)
241-AW-103	PUREX	Neutralized cladding removal waste
241-AW-104	PUREX F-18, U-3, U-4, G-8, R-8	Dilute noncomplexed waste
241-AW-105	PUREX	Neutralized cladding removal waste
241-AW-106	242-A Evaporator	Double-shell slurry feed Single-shell tank saltwell

Table 2-2. Tank Number and Type of Waste Stored in Million-Gallon Nonaging Double-Shell Tanks. (2 sheets)

Tank number	Waste stream source	Type of waste stored in tank
241-SY-101	Single-Shell tanks 242-S Evaporator	Double-shell slurry feed Single-shell tank saltwell, complexed waste
241-SY-102	244-TX-DCRT, 244-S-DCRT	Cross-site waste, single-shell tank saltwell, Plutonium Finishing Plant waste
241-SY-103	242-S Evaporator TK-C-100, 244-S	Uranium sludge waste, double-shell slurry, complexed waste

DCRT = Double-Contained Receiver Tanks.
PUREX = Plutonium/Uranium Extraction Plant.

Table 2-3. Tank Number and Type of Waste Stored in Million-Gallon Aging Waste Double-Shell Tanks.

Tank number	Waste stream source	Type of waste stored in tank
241-AY-101	NDA	Strontium- and cesium-bearing waste, depleted high-level waste, dilute noncomplexed waste, dilute complexed waste
241-AY-102	AX-152 catch tank, 204-AR waste unloading station	Neutralized high-level waste, A-417 catch tank, double-shell slurry feed, dilute B Plant 25-1 NCPLX, noncomplexed waste
241-AZ-101	PUREX	Neutralized current acid waste
241-AZ-102	PUREX	Neutralized current acid waste

NDA = No data available.

The RCRA-regulated components of the mixed waste have several potential waste classifications, including primarily RCRA characteristics [e.g., corrosivity (D002) and toxic characteristics leach procedure (TCLP) toxicity for various metals]. In addition, dangerous waste classifications of toxic, persistent, carcinogenic, and extremely hazardous waste pursuant to WAC 173-303 (WAC 1989a) also are potential designations for waste stored in the DSTs based on the presence of low concentration solvents and high concentrations of heavy metals.

Although the DSTs contain mostly inorganic waste, small amounts of organics may be present. The presence of regulated organics in the waste may be a result of chemical breakdown or recombination of organic complexing agents, laboratory and research work, or solvents that may have been added during fuel reprocessing procedures.

Waste stored in the DSTs is designated as corrosive, toxic, persistent, carcinogenic, and extremely hazardous waste in accordance with WAC 173-303 (WAC 1989a).

A maximum operational capacity of 28 Mgal of waste can be stored in the 28 DSTs. Presently, the tanks are at approximately 75% capacity. Two million gal are kept in reserve for contingency purposes (i.e., 1 M for aging waste, 1 M for nonaging waste). This effectively raises the 75% to about 83%. The volume of waste placed in or removed from storage in the DSTs varies from year to year and month to month. Normally, the PUREX Plant contributes the largest amount of waste transferred to the DSTs; however, the plant is presently in a nonprocessing mode and waste is being generated at greatly reduced volumes. During early 1990, B Plant transferred approximately 56,000 gal to the DSTs monthly. In addition, T Plant transferred approximately 209,660 gal during 1988. These waste numbers are provided for general information. Waste volume generated and transferred to the DSTs varies considerably.

In general, the majority of the waste stored in the DSTs is generated by the PUREX process. The waste-generating units that produce and transfer waste to the DSTs include the following:

- The PUREX Plant
  - Neutralized cladding removal waste
  - Neutralized current acid waste from the first extraction column (aging waste)
  - Tank F-18 miscellaneous waste
  - Tanks U3 and U4 miscellaneous waste
  - Ammonia scrubber waste
- Plutonium Finishing Plant
  - Transuranic sludge
  - Low-level processing waste supernatant
  - 242-A Evaporator concentrated double-shell slurry and double-shell feed (the 242-A Evaporator is addressed in a separate permit application)
- B Plant
  - Concentrated complexed waste and noncomplexed waste (currently not being generated)
  - Cell drainage and vessel cleanout waste
- S Plant laboratory and decontamination waste
- T Plant decontamination solutions
- 300 Area laboratory and fuel fabrication waste
- 400 Area laboratory waste
- 100 N Area
  - Dilute phosphate reactor decontamination waste
  - 100 Area spent fuel storage basin sulfate waste (from ion exchange regeneration and sand filter backwashing)
- The SSTs saltwell waste.

Waste from historical chemical process operations is also transferred to the DSTs. Before 1980, this waste was stored in SSTs. Liquid supernatant from the SSTs has been and currently is being transferred to the DSTs.

2.2 SINGLE-SHELL TANKS

2.2.1 Facility Description

2.2.1.1 Physical Characteristics. The 149 inactive (have not accepted liquid wastes since 1980) SSTs, built between 1943 and 1964, are located in 6 tank farms in the 200 East Area and 6 tank farms in the 200 West Area. The 6 tank farms in the 200 East area are: A, AX, B, BX, BY and C. The 6 tank farms in the 200 West Area are: S, SX, T, TX, TY and U. The locations of the various tank farms within the two areas are shown in Figure 2-3.

The SSTs represent four designs of tanks ranging in liquid capacity from 54,500 to 1,000,000 gal. The features found in a typical storage tank are shown in Figure 2-4. The characteristics of the tanks in each farm are summarized in Table 2-4.

The underground SSTs were built to store radioactive waste solutions from four chemical processes: the bismuth phosphate ($BiPO_4$) process, the reduction-oxidation (REDOX) process, the PUREX process, and the tributyl phosphate (TBP) process. The $BiPO_4$ process was a batch process to separate and recover plutonium from irradiated reactor fuel. The TBP process was designed to recover uranium from the waste generated by the $BiPO_4$ process. The REDOX and PUREX processes simultaneously separated plutonium and uranium from the other radioactive material in the reactor fuels and from each other by a counter-current liquid extraction process using different extractants and solvents.

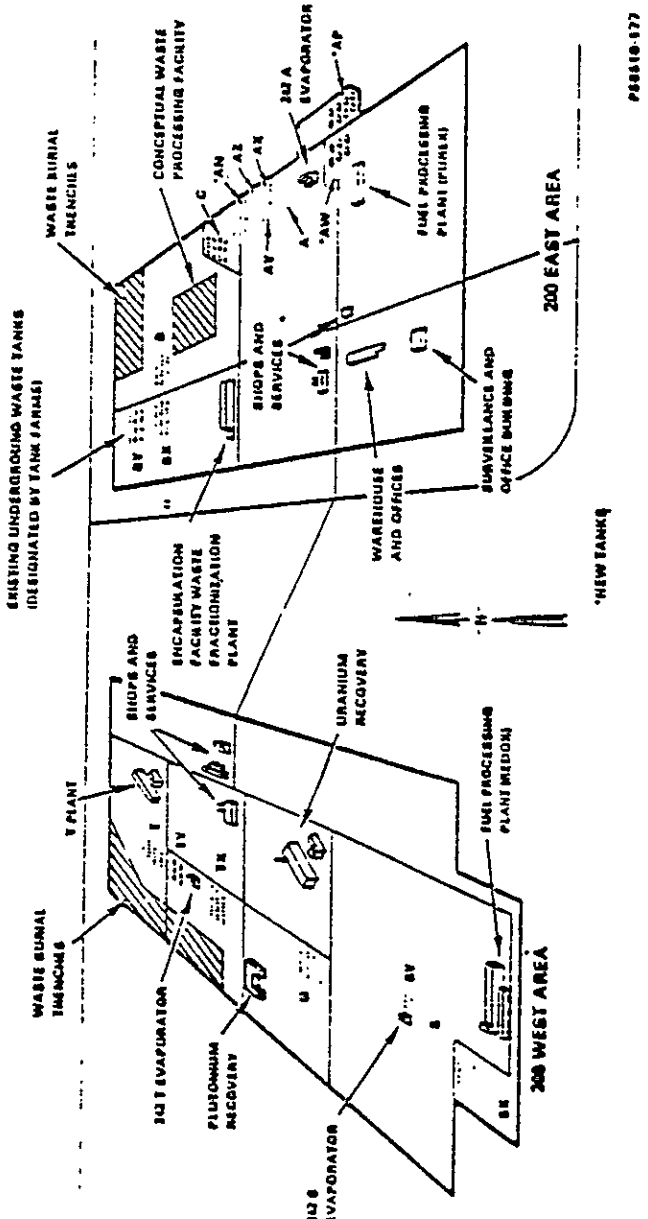
Several small waste treatment facilities were built to settle, evaporate, neutralize, and condition plant wastes to reduce the volumes sent to the SSTs, make the waste alkaline for minimizing corrosion, and remove long-lived heat generators. In many cases, the waste sent to the SSTs were recovered for subsequent treatment (e.g., TBP).

Transfer facilities and diversion boxes (to route waste from the processing facilities, treatment plants, and SSTs) and pump stations (to boost flows on routes up to 5 m) were also built. Use of the waste treatment facilities ceased as the need ended. The current status of the tanks and contents are summarized in Hanlon (1990).

Each tank farm is fenced and controlled as a surface contamination radiation area with limited personnel access via normally locked gates. Most tank farms are fenced separately but BX and BY and S, SX, A, and AX are fenced as single units. No through roads or railroad tracks traverse a tank farm.

The SSTs are constructed of mild steel, ASTM A283 Grade C (except those in the AX tank farm that are ASTM A201 Grade C), lining the bottom and sides of a concrete shell. Inlet and overflow lines are sleeved into the tank near the top of the steel liner, welded into the steel liner, and extended through an oakum-packed sleeve in the shell. The bottoms of most SSTs are slightly dished. The tanks were built to the codes applicable at the time of their construction. Current operating specifications reflect the findings of studies to ascertain the safe limits for continued storage of wastes in the SSTs.

Figure 2-3. 200 Areas Processing and Waste Management Facilities.



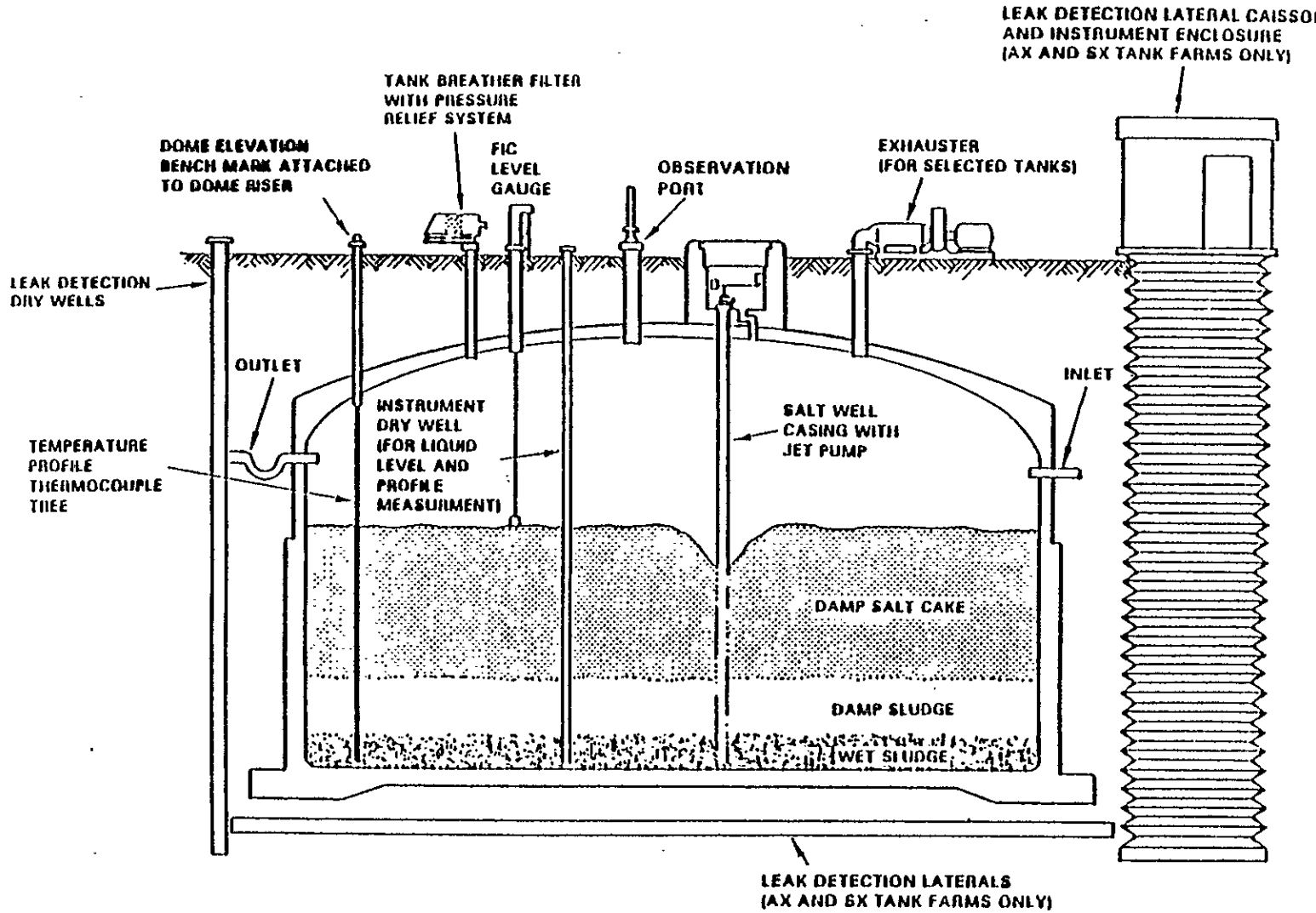


Figure 2-4. Typical Single-Shell Tank.

Table 2-4. Single-Shell Tank Characteristics.

Tank farm	Tanks per farm	Capacity per tank, (gal)	Capacity per farm, (gal)	Years for Construction
T	4 12	54,500 530,000	6,578,000	1943 - 44
U	4 12	54,500 530,000	6,578,000	1943 - 44
B	4 12	54,500 530,000	6,578,000	1943 - 44
C	4 12	54,500 530,000	6,578,000	1943 - 44
BX	12	530,000	6,360,000	1945 - 47
TX	18	758,000	13,644,000	1947 - 48
BY	12	758,000	9,096,000	1950 - 51
S	12	758,000	9,096,000	1950 - 51
TY	6	758,000	4,548,000	1951 - 52
SX	15	1,000,000	15,000,000	1953 - 54
A	6	1,000,000	6,000,000	1954 - 55
AX	4	1,000,000	4,000,000	1963 - 64

Several definitions related to tank status are provided to aid in the understanding of some information in this document. These are as follows:

Inactive tank: a tank that has been removed from liquid-processing service, pumped to a minimum supernatant liquid heel, and is awaiting disposal.

Assumed leaker: a tank for which there is an indication of a breach of integrity. Such a tank exhibits surveillance parameter changes that exceed stated criteria limits and result in a less than 95% chance that the tank is sound.

Sound tank: an active or inactive tank that exhibits no unexplained surveillance parameter changes that exceed stated criteria limits; there is a 95% or greater confidence that the tank is sound.

Partially Interim Isolated (PI): the administrative designation reflecting the completion of the physical effort required for interim isolation except for isolation of risers and piping that is required for jet pumping or for other methods of stabilization.

Interim Stabilized (IS): a tank that contains less than 50,000 gal of drainable interstitial liquid and less than 5,000 gal of supernatant liquid.

Interim Isolated (II): the administrative designation reflecting the completion of the physical effort required to minimize the addition of liquids into an inactive storage tank, sump, catch tank, or diversion box.

The current status of all the SSTs is tabulated in Hanlon (1990). All SSTs are out of service (formerly designated as inactive). One hundred eleven SSTs are interim stabilized (most liquids have been removed). The amount of liquid remaining in the SSTs ranges from 0 to 413,000 gal (241-A-101). Ninety-one have had all lines that interface with the ambient environment cut and blanked (interim isolated); the remaining 58 are partially interim isolated.

Sixty-six SSTs are designated as assumed leakers. The volumes of liquids released to the soil range from 300 gal for tank 241-B-203 (1980) to 115,000 gal from tank 241-T-106 (1973) (Hanlon 1990). These estimates do not include the potential loss of cooling water added to tank 241-A-105 to aid in evaporative cooling. The ^{137}Cs estimated to have been released to the soil under the tanks as a result of various leaks (as of September 1985) ranged from less than values to 51 Ci.

2.2.1.2 Tank Farm Background Information. A comprehensive history of the tanked Hanford nuclear wastes can be found in Jungfleisch (1984). This section provides a brief description of tank usage and history.

2.2.1.2.1 U Tank Farm. The first of four tank farms were constructed in 1943-44. Twelve of the tanks are 75 ft in diameter with a capacity of 530,000 gal. These tanks are arranged in four cascades of three tanks each; feed was pumped into the high elevation tanks and overflowed into lower tanks. The tanks are separated by a 1-ft vertical distance. The four 20-ft diameter tanks were also used to settle waste with the supernatant overflowing into a crib (soil column disposal).

Tanks 241-U-101 to -109 received metal waste from T Plant and were subsequently sluiced (a high pressure jet of liquid was used to break up solids into a slurry that could be pumped from the tank) back to the TBP recovery process in U Plant. Waste has been received from various storage tanks for processing in the 241-T Evaporator. The last cascade (tanks 241-U-110 through -112) received self-boiling first cycle decontamination waste. All three tanks were subsequently used for REDOX waste storage and evaporator feed.

The waste in 14 of the U Tank Farm SSTs is currently classified as noncomplexed (general waste term applied to all Hanford liquors not identified as complexed); 2 SSTs currently hold double-shell slurry feed (waste evaporated to a point just before reaching the sodium aluminate saturation boundary or 6.5 mol hydroxide in the evaporator. This form is not as concentrated as double-shell slurry) in Hanlon (1990). Four of the 16 tanks are assumed leakers. The contents of nine tanks have been interim stabilized, seven have been interim isolated with the remaining five partially interim

isolated. The volumes of drainable liquids in the tanks in this farm range from 1,000 gal (4 tanks) to 196,000 gal (241-U-108) with other tanks holding 122,000 gal (-111), 144,000 gal (-102), 178,000 gal (-107), 179,000 gal (-105), 182,000 gal (-109), and 189,000 gal (-103). The farm is currently estimated to contain a total of 1,306,000 gal of drainable liquid, the largest volume of any SST farm (Hanlon 1990).

2.2.1.2.2 T Tank Farm. As with the U Tank Farm, the T Tank Farm was one of the first four tank farms built in 1943-44. The farm's physical characteristics are the same as U Tank Farm's. The tanks received metal waste (nonboiling) from the T Plant $BiPO_4$ process in late 1945 with decontamination waste sent to other cascades. The tanks were subsequently emptied and received wastes from other facilities (221-T, ion exchange waste, and TBP waste from CR area generated after the fourth cascade in C Tank Farm became full).

All the waste in T Tank Farm is noncomplexed. Six tanks within the T Tank Farm are classified as assumed leakers. The contents of 11 SSTs have been interim stabilized and interim isolated. The remaining five have been partially interim isolated. The volumes of drainable liquids in the tanks range from 0 (2 tanks) to 51,000 gal (241-T-111). The farm is currently estimated to contain a total of 263,000 gal of drainable liquid (Hanlon 1990).

2.2.1.2.3 B Tank Farm. B Tank Farm was built in 1943-44 as one of the first four tank farms constructed. Its physical characteristics are the same as for the U and T Tank Farms. B Farm SSTs were used to settle and store low-level waste from B Plant, primarily the first- and second-cycle cladding removal waste and evaporator bottoms. Tanks 241-B-102, -103, -106, -108, and -109 were modified to accept in-tank solidification (ITS-1 and ITS-2) evaporator bottoms. Residual liquor was removed from four tanks (241-B-101, -105, -107, and -110) when they were placed out of service and pumped to tank 241-B-102.

All the waste in B Tank Farm is currently designated as noncomplexed. Ten of the tanks are assumed leakers. The contents of all 16 SSTs have been interim stabilized and interim isolated. The drainable liquids in the tanks in this farm ranges from 0 (1 tank) to 47,000 gal (241-B-104). The farm is currently estimated to contain 179,000 gal of drainable liquid (Hanlon 1990).

2.2.1.2.4 C Tank Farm. The C Tank Farm was one of four tank farms constructed in 1943-44 and shares physical characteristics and arrangement with T, U and B Tank Farms. Tanks 241-C-101 through -106 were used to store metal waste and -107 through -112 were used to store first-cycle B Plant decontamination wastes beginning in March 1946. In 1953, the waste stored in the first cascade (Tanks 241-C-101 through -103) was removed and the tanks were converted to receiver tanks for the TBP process. Other tanks in the farm were also used as feed and receiver tanks for fission product waste processing from the PUREX Plant in the 244-CR Waste Vault. This processing left large quantities of ^{90}Sr in Tank 241-C-106. (As of 1985, this tank contained the highest heat load of the SSTs--183,000 Btu/h by psychometric data.) Tanks 241-C-103, -104, and -107 also received insoluble strontium-leached sluicing solids from the operations in the 244-CR Waste Vault.

Fourteen tanks in C Farm currently contain noncomplexed waste. One (241-C-104) holds complexed waste [dilute waste material containing relatively high concentrations of chelating agents (e.g., ethylenediamete-tetraacetic acid [EDTA], N-[hydroxyethyl]-ethylenediamenatriacetate acid [HEDTA] from B Plant waste fractionation operation], and one is listed as empty (241-C-202). Seven of the tanks are assumed leakers. Nine of the SSTs in this farm have been interim stabilized, eight have been interim isolated, and the other eight partially interim isolated. The volume of drainable liquid in the tanks ranges from 0 (5 tanks) to 48,000 gal (241-C-102 and -106). The farm is currently estimated to contain 224,000 gal of drainable liquid (Hanlon 1990).

2.2.1.2.5 BX Tank Farm. The 12 SSTs in this farm were built in 1946-47 using the design for the 75-ft diameter tanks in B Tank Farm. Tanks 241-BX-101 through -106 (first 2 cascades) received B Plant metal waste until January 1950. The remaining tanks (241-BX-107 through -112) received B Plant first-cycle and Cell 23 concentrated wastes. Tank 241-BX-110 received evaporator bottoms during the first in-tank solidification program and several other tanks were used to stage the feed. The first two cascades also received TBP waste.

The waste in all 12 BX Tank Farm SSTs is currently classified as noncomplexed. Five of the tanks are assumed leakers. The contents of seven of the SSTs in this farm have been interim stabilized, five tanks have been interim isolated, and seven tanks have been partially interim isolated. The volume of drainable liquids in the tanks in this farm ranges from 1,000 gal (2 tanks) to 69,000 gal (241-BX-111). The farm is currently estimated to contain 214,000 gal of drainable liquid (Hanlon 1990).

2.2.1.2.6 TX Tank Farm. The TX Tank Farm consists of 18 SSTs, constructed in 1947-48, of a modified B Tank Farm design that increased the capacity of the tanks to 750,000 gal. The tanks are arranged in three cascades of four tanks and two cascades of three tanks with only half the tanks actually used in cascades. Tanks 241-TX-101 through -108 were filled during the 1950's with T Plant metal waste. Subsequently, six of the tanks were sluiced empty and received REDOX wastes. Tanks 241-TX-103 and -108 were used to store TBP waste from tanks being emptied by sluicing. In later years, these tanks were used for bottoms and recycle for the 241-T Evaporator. Tanks 241-TX-108 through -112 were used to store first cycle decontamination wastes before use with the 241-T Evaporator. Tanks 241-TX-113 through -118 were not used until the early 1950's as feed, bottom and recycle tanks in conjunction with the 241-T Evaporator.

The materials currently stored in all 18 SSTs in the TX Tank Farm are classified as noncomplexed waste. Eight of the tanks are assumed leakers. The volume of drainable liquids in the tanks in this farm ranges from 0 (1 tank) to 27,000 gal (241-TX-118). The farm is currently estimated to contain a total of 255,000 gal of drainable liquid. The contents of all the tanks in this farm have been interim stabilized and interim isolated (Hanlon 1990).

2.2.1.2.7 BY Tank Farm. The tanks in this farm were constructed in 1948-49 as a backup for BX Tank Farm using the modified B Tank Farm design for a 75-ft diameter, 750,000 gal capacity tank. The tanks were configured as

four cascades of three tanks each. Tanks 241-BY-101 through -106 received B Plant metal wastes, Tanks 241-BY-107 through -110 received B Plant first-cycle and TBP wastes, and 241-BY-111 and -112 were used for temporary storage of metal waste. Subsequently, some tanks were used for feed staging and bottoms storage during the two in-tank solidification programs with the 242-B Batch Evaporator.

The waste currently stored in all 12 SSTs in this farm is classified as noncomplexed waste. Five of the tanks in this farm are assumed leakers. The volume of drainable liquids in the tanks in this farm ranges from 0 (1 tank) to 235,000 gal (241-BY-106) with tank 241-BY-102 holding 191,000 gal, -103 holding 108,000 gal, -105 holding 172,000 gal, and -109 holding 180,000 gal. The farm is currently estimated to contain 982,000 gal of drainable liquid. The contents of seven of the SSTs in this farm have been interim stabilized, three SSTs have been interim isolated, and the remaining nine are partially interim isolated (Hanlon 1990).

2.2.1.2.8 S Tank Farm. The 12 750,000-gal capacity SSTs in this farm were constructed in 1950-51 using a second-generation tank design that retained the 75-ft diameter with an increased operating depth. Segregation of wastes was not practiced until 1955 and the tanks were used to store a variety of REDOX wastes. Self-concentration was initiated in 1953 in tanks 241-S-101 through -106 with the installation of surface condensers. The condensates were disposed of via cribbing. Additional concentration of the wastes in these tanks was achieved using the 242-S Evaporator in the 1970's.

The waste currently stored in 10 tanks is classified as noncomplexed and waste in 2 tanks (241-S-102 and -103) is classified as double-shell slurry feed (waste evaporated just past its sodium aluminate saturation boundary or 6.5 mol hydroxide in the evaporator. This form is not as concentrated as double-shell slurry.). Only one tank (241-S-104) is an assumed leaker. The volume of drainable liquids in the tanks in this farm ranges from 29,000 gal (241-S-104) to 230,000 gal (-102). Other tanks having significant quantities of drainable liquids are: -102, 103,000 gal; -106, 115,000 gal; -108, 103,000 gal; -109, 124,000 gal; -111, 202,000 gal; and -112, 144,000 gal. The farm is currently estimated to contain 1,291,000 gal of drainable liquid. The contents of 2 tanks in S Tank Farm have been interim stabilized, 1 tank has been interim isolated (241-S-104), and the remaining 11 tanks have been partially interim isolated (Hanlon 1990).

2.2.1.2.9 TY Tank Farm. The six tanks in this farm are of the same design as used for the S Tank Farm SSTs and were constructed in 1951-52. The tanks were used to settle and decant low-level waste as lag-storage for the 242-T Evaporator feed.

The wastes currently stored in these tanks are classified as noncomplexed waste. Five of the six tanks in this farm are assumed leakers. The volume of drainable liquids in the tanks ranges from 0 (3 tanks) to 15,000 gal (241-TY-104). The farm is currently estimated to contain 34,000 gal of drainable liquid; the smallest volume of any SST tank farm. The content of all six tanks have been interim stabilized with five interim isolated and one partially interim isolated (Hanlon 1990).

2.2.1.2.10 SX Tank Farm. The design of the tanks in this farm represents the third generation of storage tank design. These 15 tanks were constructed in 1953-54 and have a nominal capacity of 1,000,000 gal each. The tanks are designed to contain self-boiling waste. Original construction included underground duct headers to a common condenser-ventilation system. Operations began in this farm in 1954 with REDOX salt waste and first-cycle condensate in Tanks 241-SX-101 through -106. Self-boiling began almost immediately for the salt waste but did not initiate for the first-cycle condensate until 1956. After several years of concentration by self-boiling, the tanks were used as receiver tanks and to store bottoms for the 242-S Evaporator.

The waste in 11 tanks is classified as noncomplexed, 3 hold double-shell slurry feed and 1 holds completed waste. Ten of the tanks in this farm are assumed leakers. The volume of drainable liquids in the tanks ranges from 0 (3 tanks) to 261,000 gal (241-SX-105). Other tanks having large drainable liquid volumes are: -101, 146,000 gal; -102, 183,000 gal; -103, 258,000 gal; -104, 138,000 gal; and -106, 255,000 gal. The farm is currently estimated to contain 1,286,000 gal of drainable liquid. The contents of nine of the tanks in this farm have been interim stabilized. Nine SSTs are interim isolated and the remaining six are partially interim isolated (Hanlon 1990).

2.2.1.2.11 A Tank Farm. The six tanks in this farm were constructed in 1954-55 using a fourth-generation design for the waste tanks. The tanks have a 1,000,000 gal capacity with a 31-ft operating depth and a flat bottom. The design of the risers varies somewhat from the second- and third-generation tanks and vitreous clay condenser risers connect the tank to above-ground fluid-to-air condensers. Starting in 1956, Tanks 241-A-101 through -104 and -106 were used to store self-boiling PUREX Plant high-level waste. Tank -104 also received PUREX Plant organic wash waste and -106 received both organic and inorganic wash waste. In the mid-1970's, four tanks were sluiced for use as 242-A Evaporator bottoms receiver tanks and -102 was used for a short time as a feed tank for that evaporator. Tank 241-A-104 was found to be leaking and was pumped to dry sludge.

Tank 241-A-105 received PUREX inorganic wash waste for approximately 3 yr before undergoing a violent reaction in January 1965. One of the consequences of the reaction was a bulge in the bottom of the tank approximately 50 ft in diameter x 8 ft high. The tank was removed from service and was cooled for the next 10 yr by using an active ventilation system and sprinkling small amounts of water on the waste surface. Not all of the cooling water is believed to have evaporated and an undetermined amount may have leaked from the tank to the soil. This cooling water is not included in the estimates of leakage to the soil provided in Hanlon (1990). Although the sludge believed trapped under the liner could not be safely removed, the tank was essentially emptied of liquid in 1977 and a hole was chemically milled at the top of the bulge to allow the radiolytic hydrogen formed to vent. The temperature under the tank is monitored via probe in the lateral well running under the tank. The tank is cooled by an active exhaust system (Stack 296-P-1).

The waste in three SSTs in the A Tank Farm is currently classified as double-shell slurry feed, in two SSTs as noncomplexed, and in one SST as concentrated phosphate waste (waste originating from the decontamination of 100 N Reactor that has been diluted). Three tanks are assumed leakers. The

volume of drainable liquids in the tanks in this farm ranges from 0 (1 tank) to 413,000 gal (241-A-101). Tank 241-A-105 is currently listed as having 4,000 gal of drainable liquid. The farm is currently estimated to contain 447,000 gal of drainable liquid. The contents of five tanks have been interim stabilized. Four tanks have been interim isolated and two tanks are partially interim isolated (Hanlon 1990).

2.2.1.2.12 AX Tank Farm. The four tanks in this farm are the last SSTs constructed on the Hanford Site. The tanks were built during 1963-64 using the same design as the A Tank Farm SSTs with a grid of drainage slots added under the steel liner bottom to provide timely observation and collection of potential liquid tank leakage. The riser arrangement was significantly modified to provide access for in-tank air circulators (air-lifters) to agitate the waste and prevent the type of incident that occurred in the 241-A-105 tank. The farm was built for self-boiling waste. Tanks 241-AX-101 and -102 were used to store B Plant high-level waste. Tank 241-AX-103 was used for PUREX organic and inorganic wastes. Tanks 241-AX-101 and -104 received some PUREX high-level waste. Subsequently, Tanks 241-AX-101 through -103 were sluiced and used for evaporator slurry receiver tanks in the mid-1970's. The integrity of Tank 241-AX-104 was in question and this tank was not used as an evaporator tank.

The waste in Tank 241-AX-101 is currently classified as double-shell slurry feed, in Tank 102 as concentrated complexant (concentrated product from the evaporation of dilute complexed waste), in Tank 103 as complexed waste, and in Tank 104 as noncomplexed. Two tanks are currently classified as assumed leakers. The volume of drainable liquid in these SSTs ranges from 0 (-104) to 298,000 gal (-101). The farm is currently estimated to contain a total of 373,000 gal of drainable liquid. The contents of three tanks have been interim stabilized. Three tanks are interim isolated and one, Tank 101 is only partially interim isolated (Hanlon 1990).

2.2.2 Effluents

2.2.2.1 Gaseous Effluent System. Two methods of confining the SSTs' gaseous atmospheres and treating the airborne particulates generated within the SSTs are currently used. The 11 SSTs with high heat loads (>40,000 Btu/h) (Hanlon 1990) are on active ventilation systems; the remaining 128 SSTs are on passive breather systems. The gaseous effluent treatment system is used in this document as the FEMP determination criterion for the SSTs.

The analyses are based on the normal, anticipated pathways through the SSTs that were determined by previous analysis. It is recognized that other pathways for release to the environment may result under different conditions. If a tank-by-tank analysis for all possible conditions were performed, the ramification of all possible release pathways would be evaluated. For determining whether a FEMP is needed, assessing the potential for emission via the predicted pathways appears to be most useful.

2.2.2.1.1 **Active Ventilation System.** Active ventilation systems are used for the following:

- C Tank Farm exhauster 296-P-16 that services tanks 241-C-105 and -106
- SX Tank Farm exhauster 296-P-15 that services all the SX Farm tanks except 241-SX-113 and -115, which are passively ventilated
- A Tank Farm exhauster that services all six A Farm tanks via an old underground header, but is only required for tank 241-A-105.

Each active exhauster used with SSTs normally contains, in the order of flow, the following:

- A preheater to lower the relative humidity in the airstream
- A roughing filter to screen large particles from the HEPA filters
- Two banks of HEPA filters in series
- A fan to draw the air through the system
- A damper/valve to regulate the airflow
- A stack to direct the exhaust air away from the occupied areas
- A sampling unit in the stack to collect a record sample of the radioactive particles discharged in the effluents and a continuous air monitor (CAM) that detects the quantity of radioactivity in the particulate emissions and alarms when predetermined levels are exceeded.

C Tank Farm Ventilation. This system consists of a deentrainer, electric heaters to decrease the relative humidity in the air, HEPA filters, and a permanently installed skid-mounted centrifugal blower. Twelve-inch-diameter valved inlet ducts allow the air to sweep through each tank. The estimated volumetric flow rate through the tanks is 1,200 ft^3/min for Tank 241-C-105 and 2,400 ft^3/min for Tank 106. The liquid droplets and large particulates removed by the deentrainer drain back into Tank 106. Both the heater and deentrainer are designed to protect the HEPA filters from moisture and ensure proper function. A temporary exhauster is used during filter changes.

SX Tank Farm. This system includes three parallel banks of HEPA filters (two operating and one standby). Portable exhausters are not required for filter changes. The heaters are operated using 90 psig steam passing through 2 coils located in the inlet plenum. Steam condensate drains to Crib 216-S-25. Process condensate drains to the 241-SX-106 tank. Structural failure of the steam coil would force steam condensate into the ventilation system because pressure in the coils is greater (90 psig) than in the ventilation system. The volumetric airflow rate is from 300 to 500 ft^3/min per tank for a total flow rate of 3,000 ft^3/min to 6,000 ft^3/min through the system.

Seven air inlets allow the air to sweep through the tanks - two are valved; the remaining five must be manually sealed when the exhauster is not operating. All SSTs in this tank farm are on the active ventilation system, except Tanks 241-SX-113 and -115, which are equipped with passive breathers (HEPA filters).

A Tank Farm. The system consists of a HEPA-filtered inlet and an exhauster system mounted on tank 241-A-105. Although only Tank 241-A-105 requires the active ventilation system, all tanks in this farm are connected via an underground vent header, allowing minimal airflow through the other five tanks. The volumetric airflow rate through Tank 241-A-105 is approximately 2,300 ft^3/min. A portable exhauster system is used during filter changeout.

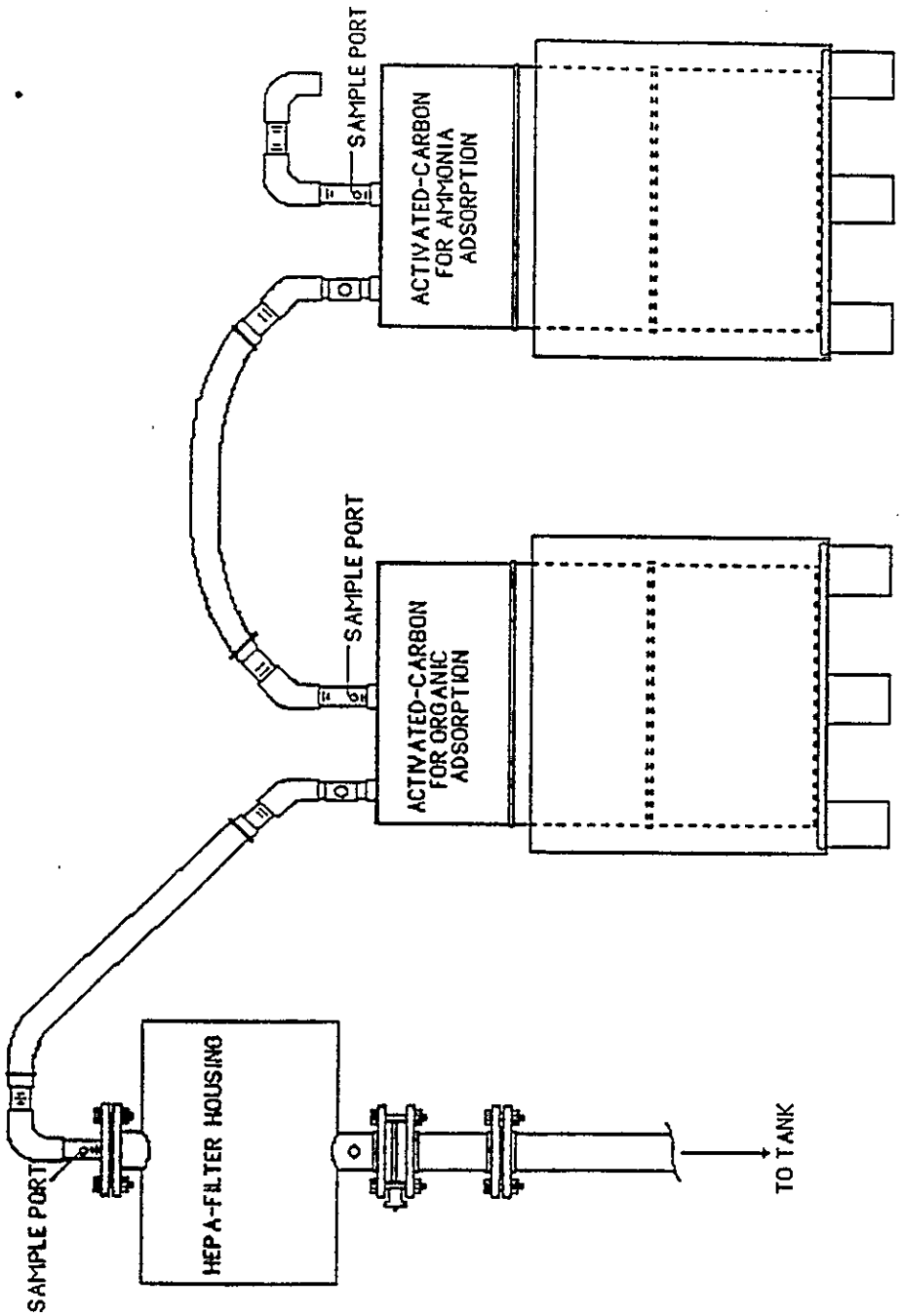
2.2.2.1.2 Passive Ventilation System (Passive Breathers). All SSTs not requiring active ventilation are equipped with passive ventilation systems called "breather filters." These systems are designed to allow air passage at low differential pressures and to minimize pressure (e.g., owing to barometric pressure change or temperature differentials) changes that could damage the tank structure if the tanks were completely sealed.

Three designs of breather filters are currently in use. Each breather filter installation consists of a pipe connection to the SST, an outlet screen, and a small seal loop (filled with inert silicone fluid having a low vapor pressure and high viscosity) that acts as a pressure relief should the filter become plugged. Test ports to determine the particle capture efficiency of the HEPA filters are provided on both the upstream and downstream sides of the filter. Some designs incorporate heaters to prevent possible filter freezeup during winter, but several years experience has demonstrated that the heaters are not necessary. All three designs are specified to allow 125 ft^3/min at a differential pressure of 4-in. wg. Seal loops are inspected weekly and refilled as necessary. HEPA filters are tested at least semiannually; some are tested quarterly and few even more frequently.

Concerns over the potential release of organic vapors and ammonia, prompted the installation of additional filters to the passive breather arrangement for Tank 241-C-103 in the C Tank Farm. Free volume samples were taken at three levels in Tank C-102, a tank with a high organic content (Tranbarger 1990), and Tank C-103. Analyses of the vapors indicated six major constituents: normal paraffin hydrocarbon (NPH), ammonia, acetone, 1-butanol, 4-methyl-2-pentanone (hexone), and tributly phosphate (TBP). A 1,000 ft^3/min inlet filter was placed on Tank C-102 and a portable 1,000 ft^3/min exhauster was attached to the filter on Tank C-103. The tanks were then evacuated to maintain the headspace vapor concentration at low levels. Activated carbon filters were designed to remove both the organic vapors and ammonia.

The arrangement is shown in Figure 2-5. Gases exhausted from Tank C-103 are passed through a HEPA filter, a 55-gal drum filled with activated carbon to remove the organic vapors, and a 55-gal drum filled with phosphoric acid-coated activated carbon to remove ammonia. The drums are traced-heated and insulated to prevent moisture condensation. Calculations indicate that

Figure 2-5. Carbon Filtration System.



heating the carbon filter may induce a continuous flow out of the tank. Flow is also caused by barometric pressure changes (Tranbarger 1991). The additional activated carbon filters were installed at the end of 1989 and the exhauster was removed. Tanks C-102 and -103 are currently on passive breathers.

2.2.2.2 Liquid Effluent System. The only routine liquid effluent anticipated for the SSTs is the condensate from the steam-heated coil in the SX Tank Farm and from possible condensate in the active ventilation system. As described in the previous section, the coils operate using 90 psig steam and any loss of coil integrity would introduce steam and water into the ventilation system inlet duct. The liquid normally drains back into the 241-SX-106 tank. The condensate from the coils drains to Crib 216-S-25. This liquid stream has a potential to be contaminated. The process condensates deposit in the exhaust ducts and headers and drain back into the SSTs.

Liquid intrusions into the SSTs do not appear to be a highly probable event. At a minimum, all connections from the SSTs to the ambient atmosphere except the risers and piping required for jet pumping or other methods of stabilization have been removed (definition of partially interim isolated). Moisture percolating through the soil around riser and piping connections to the SST may leak into the tanks if the connections are not sound. Given the climatological conditions of the area, large amounts of liquids are not anticipated at a depth of 5 ft to 9 ft below grade. For those systems requiring active ventilation for cooling (A, BY, and SX Tank Farms), moisture entrained in the exhaust gases may condense in the ventilation risers and drain back into the tanks.

2.3 204-AR WASTE UNLOADING FACILITY

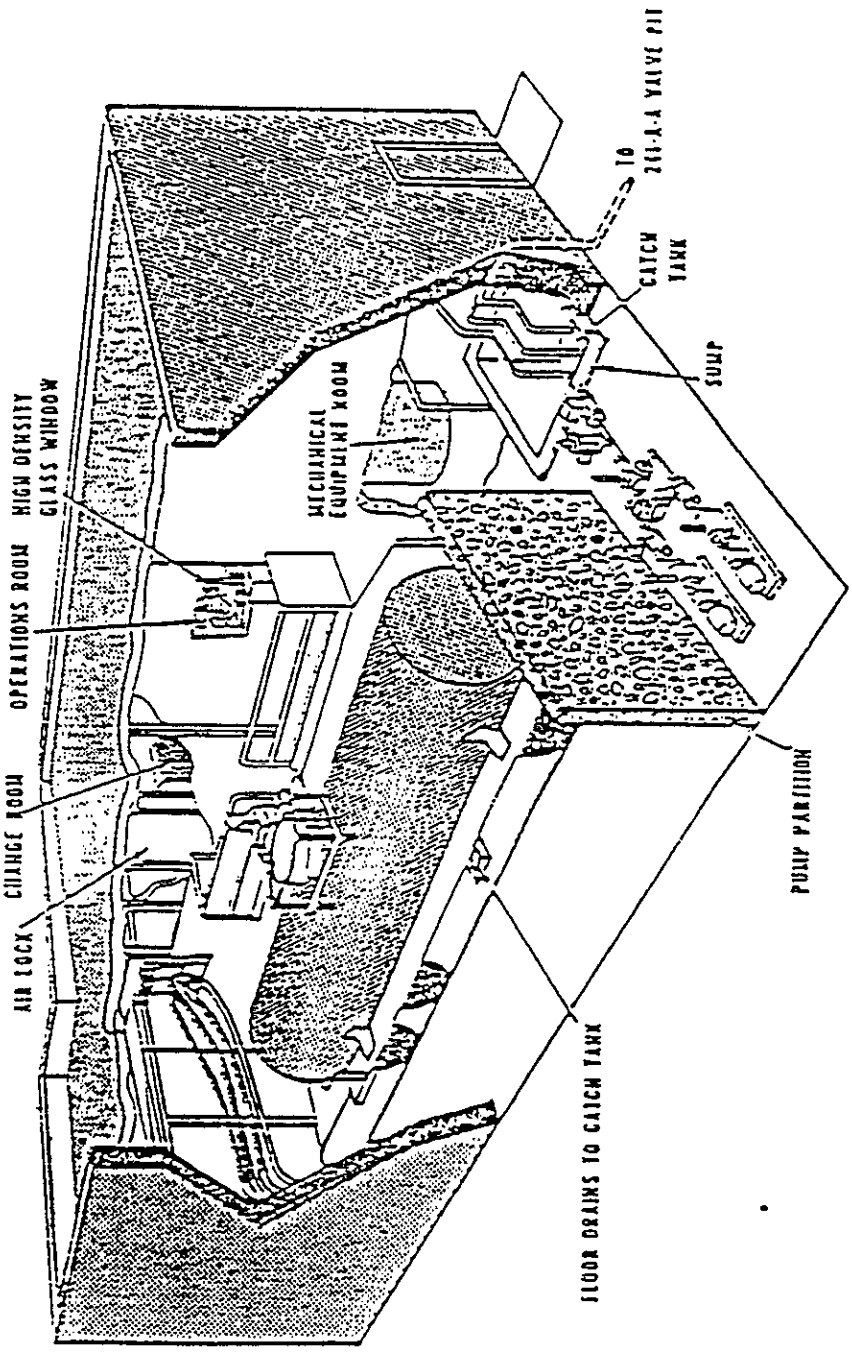
2.3.1 Facility Description

The 204-AR Waste Unloading Facility is a two-story, structural steel, reinforced-concrete building in the 200 East Area (Figure 2-6). The 204-AR facility receives liquid waste generated by U.S. Department of Energy, Richland Operations Office (DOE-RL) contractors and transported in railroad tank cars or tanker trucks for direct transfer to underground waste storage tanks and subsequent processing in the 242-A Evaporator/Crystallizer. The fully enclosed 204-AR facility replaced the outdoor facility (204-S) located in the 200 West Area. Operation of the 204-AR facility allows storage of waste in DSTs without requiring cross-site transfers from the 200 West Area.

The two-story 204-AR facility is approximately 25.5 ft high, 64 ft long, and 40 ft wide. The facility is constructed of reinforced, cast-in-place concrete walls and structural steel columns. The first and second floors are reinforced-concrete slabs. The building is divided into three primary sections: the unloading area, the mechanical equipment room, and the personnel offices and facilities (operations and change rooms).

The unloading area houses the railroad tank car or tanker truck, the slurry and water booster pumps, the waste catch tank and associated valving and piping, and ventilation exhaust ductwork housing the first-stage HEPA

Figure. 2-6. 204-AR Waste Unloading Facility.



filters. Quick-disconnect fittings on stainless steel flex hoses are suspended from the ceiling to allow easy coupling of the tank car or tanker truck to the process piping. Access to the top of the tank car or truck is from the balcony onto a fold-down platform through an opening with a swing-type gate.

The tank car or tanker truck enters the unloading area through a roll-up door, then a vestibule, and hinged steel doors. The vestibule is not a real airlock; it is too small to contain a tank car. However, when both the outer and inner doors are closed, they serve as a double barrier for this large opening. Rail car stops are installed to allow easy spotting of the tank car, as well as to prevent accidental damage to unloading area equipment at the end of the railroad track. Floor and wall surfaces subject to contamination are coated with a vinyl-base paint and corners are rounded to facilitate decontamination.

The first-floor mechanical equipment room houses the process equipment for the facility; the motor control center; the building heating, ventilation, and air conditioning (HVAC) equipment; and the air compressor for instrument air supply. Two floor drains to the waste catch tank (TK-1) facilitate cleanup. The drains are provided with 9-in. loop seals to minimize venting from the catch tank into the room.

The mechanical equipment room also houses chemical storage tanks, which are designated TK-2, TK-3, TK-4, and TK-5.

Chemical Storage Tank TK-2 is a 500-gal carbon steel storage tank used for mixing and storing sodium nitrite solution. Process lines run sodium hydroxide and raw water for adjusting the pH of the waste to the tank. A port allows for manual addition of chemicals. TK-2 is also equipped with a mixing agitator, overflow and drain lines leading to a 3-in. floor drain, and liquid-level instrumentation.

The tank solution temperature is controlled by a steam-heating coil (20 psig or 77,900 Pa gauge). A temperature-sensing element located near the bottom of the tank is interconnected with a steam control valve to automatically regulate the steam and maintain a solution temperature of 60 °F. The steam condensate from the heating coil is routed to the floor drain and directed to the waste catch tank in the unloading area.

Chemical Storage Tank TK-3 is a 500-gal stainless steel storage tank used for mixing and storing sodium hydroxide solution. The addition of strong acids to any of the chemical makeup or storage tanks in the 204-AR facility is precluded by administrative controls. The tank has process lines, overflow and drain lines, a chemical addition port, an agitator, liquid-level instrumentation, and steam heating as described for TK-2.

Chemical Storage Tank TK-4 is a 200-gal stainless steel tank used for makeup and storage of phosphate buffer solution. The tank is equipped with process lines, a chemical addition port, an agitator, liquid-level instrumentation, and overflow and drain lines as described for TK-2 and TK-3. Steam heating is not provided.

Chemical Storage Tank TK-5 is a 1,800-gal carbon steel tank used for storing sodium hydroxide solution in concentrations up to 50%. The tank is equipped with process lines, liquid-level instrumentation, overflow and drain lines, and steam heating as described for TK-2 and TK-3. A chemical addition port and an agitator are not provided because sodium hydroxide is added to the tank via a line to the mechanical equipment room exterior. A 20-gal/min transfer pump is used to move sodium hydroxide to TK-2 for basic decontamination solution makeup.

Tanks TK-2, TK-3, and TK-4 are vented to the mechanical equipment room atmosphere through the existing opening in the top for the agitator shaft; TK-5 is vented through the overflow line.

Tank TK-1 is a 1,500-gal stainless steel catch tank used to temporarily store process solutions flowing through the floor drain system. The catch tank is located beneath the floor of the unloading area in a stainless steel-lined pit with a sump. The pit is covered with a removable steel grating. The catch tank is equipped with liquid-level instrumentation, an overflow line that dumps to the tank pit sump, inlet connections for the drain lines and decontamination solution, and a 3-in. pumpout line.

The bottom of the tank is sloped 0.0625 in./ft toward the pumpout line. The catch tank is vented to the ventilation exhaust plenum via a demister filter and a single-stage HEPA filter. A hydraulically driven catch tank sluicer removes solids from the tank interior, minimizing radionuclide accumulation.

The sump pit has a leak detector with alarms mounted in the operations room at 242-A. The sump pit also has a pumpout line. The common drain line from the three unloading area drains has a manual valve just before it ties into the catch tank. The valve is used for routine, hydrostatic integrity checks on the line. Because closing this valve during operations defeats the drain line's main purpose, operating procedures require that the valve be locked and tagged in the open position except when being tested.

The second-floor personnel offices and facilities include the operations room and a locker and change room. The facilities are sized for a normal occupancy of three operating personnel. The personnel entrance to the waste unloading area and the balcony is protected by an airlock. A CAM station is provided at the entrace to the change room.

A HEPA filter ventilation system exhausts contaminated and potentially contaminated air from the tank car unloading area, the catch tank, and the change room. The exhaust air is drawn into exhaust vent ductwork by an in-line fan (EF-1) located in the mechanical equipment room, a clean area. Before being discharged to the atmosphere through Stack 296-A-26, this air is filtered through two HEPA filters in series. The facility exhaust stack is 296-A-26-204-AR; the sampling and monitoring system consists of a record sampler and a beta-gamma CAM unit.

2.3.2 Process Description

Wastes shipped to the 204-AR facility are pumped into an underground waste storage tank and the tank car is internally flushed and externally decontaminated for release and return to the customer.

When the tank car has been spotted in the facility and the access doors are closed, an operator working from the balcony connects the process piping to the tank car. On tank cars equipped with dome cupolas, the cupola vent/drain hose must be connected first to relieve any pressure or vacuum before opening the lid.

Tank car unloading operations are performed and the tank car contents are recirculated through the sluice recirculation loop to ensure uniform mixing. Sodium hydroxide and/or sodium nitrate, as required, are added to meet process specifications.

Following recirculation, the tank car contents are pumped to the tank farm through the 241-A-A valve pit. If solids are present, the transfer may be stopped just before the tank car is empty and the solution recirculated through the sluice nozzle to ensure that all settled solids are agitated and in slurry. This action also prevents the possibility of a criticality occurrence. The tank car contents are then pumped to the tank farm until the slurry pump reaches suction.

The tank car is then cleaned internally by valving raw water through one of the slurry pumps and into the sluice nozzle while using the other slurry pump to remove an equal volume of solution. After approximately 1,000 gal of water have been added through the sluice nozzle, the pump suppling water to the sluice nozzle is shut down and the other pump is allowed to run until it reaches suction. Then the external surface of the car can be decontaminated if required. The cleaned tank car is ready for return to the shipper.

The 204-AR facility standard operating procedures for processing are organized into three principal categories, based on the operation's specific purpose.

The first category, solution transfers from the 204-AR facility to the tank farm, includes the following:

- Tank car to tank farm
- Sluicing water to tank car to tank farm
- Catch tank to tank farm
- Sluicing water to catch tank to tank farm.

The second category, internal solution transfers in the 204-AR facility, includes the following:

- Adding chemicals to tank car or catch tank
- Recirculating/mixing tank car contents

- Recirculating/mixing catch tank contents
- Sump to catch tank.

The third category includes the following:

- Receiving, connecting, and releasing tank cars
- Sampling tank car and catch tank
- Ventilation system operation
- Changing HEPA filters
- Routine and stored tank car surveillance
- Chemical makeup in 204-AR.

The unloading operation is monitored and remotely controlled from the operations room panelboard. Normally waste is not sampled at the facility; it is sampled before being transferred to the facility. However, the waste pH can be adjusted at the facility.

2.4 244-CR VAULT

2.4.1 Facility Description

Salt well waste, which is stored in SSTs, was originally generated during chemical processing operations. The supernatant and interstitial liquid are pumped to catch stations for temporary storage. They are then pumped from the catch stations to DSTs. From the DSTS, they are pumped to the 242-A Evaporator for concentration. From the evaporator, the concentrate is pumped back to DSTs to allow the remaining chemical salts to crystallize and form double-shell slurry concentrate.

Salt well waste is collected in the following catch stations and receiver vaults: 244-TX, 244-U, 244-BX, 244-A, 244-CR, 244-S, and DST 101-AN. It is then transferred as follows:

- From T, TX, and TY Farms to 244-TX; then to TK-102-SY for cross-site transfer to East Area DSTs
- From S and SX Farms to 244-S; then to TK-102-SY for cross-site transfer to East Area DSTs
- From B, BX, and BY Farms to 244-BX; then to an East Area DST
- From C Farm to 244-CR; then to a designated DST
- From A and AX Farms to TK-101-AN

- U Farm waste will be collected in 244-U; then sent to TK-102-SY for cross-site transfer to East Area DSTs.

Salt well waste is now processed through the 242-A Evaporator/ Crystallizer. In the past, the 242-S Evaporator/Crystallizer processed salt well liquor.

The 244-CR Vault is a two-level, multicell structure constructed below grade. The lower cell contains the process tanks; the upper cells contain piping and equipment. The vault structure is covered by concrete cover blocks which, when removed, permit access to the piping and equipment cells. The 244-CR Vault is located in the 200E Area as shown in Figure 2-7.

The vault is a reinforced concrete structure (Figure 2-8) that houses two 40,000-gal tanks (CR-011 and CR-001) and two 15,000 gal tanks (CR-002 and CR-003). The CR-003 tank is used as a salt well waste receiver tank. The two large tank vaults are each 22 ft by 26 ft by 29 ft high. Each tank vault is covered with a 2-ft-thick concrete slab that can be removed in sections to permit crane access to the tank vault below. The area above each of the large tank vaults is 22 ft by 26 ft by 22 ft to the top of the cover blocks. The two smaller tank vaults are each 16 ft by 20 ft by 19 ft high.

All dividing walls, side walls, slabs, and cover blocks of the 244-CR Vault are 2-ft-thick concrete. Each tank vault is equipped with a sump, 2 ft by 3 ft by 1 ft deep.

The CR-003 tank is equipped with a waste transfer pump and instrumentation for measuring specific gravity, weight factor (WF), and temperature.

The vault is ventilated by air at ambient pressure and temperature entering the vault through openings between cell cover blocks. Air from the upper cells enters the lower cells through exhauster ports. Air is removed from the lower cells near floor level through exhauster stacks that limit and balance their air flow. A 30-in.-dia. inlet header supplies filtered air, via subheaders, to the pump pits and to the four vault sections containing the CR-001, CR-011, CR-002, and CR-003 tanks. Exhaust air from the tanks, pump pits, and vault areas is routed to the inlet plenum of the exhaust filters. Two exhaust fans (one operating, one in standby), each rated at 4,200 ft^3/min and 10 in. w.g. provide the power for supply and exhaust air. Loss of power to the fans will activate an alarm on the operating control panel. The alarm signal will also be transmitted to 244-AR. The vault ventilation system is shown in Figure 2-9.

The final exhaust point for the system is the 296-C-5-CR Stack, attached to 291-CR, which exhausts filtered air from the vault cell and process ventilation. The sampling and monitoring system consists of an upgraded generic record sampler and a beta-gamma CAM unit.

Vault ventilation control and operation is described in detail and illustrated in TO-060-205.

Figure 2-7. Location of the 244-CR Vault in the 200E Area.

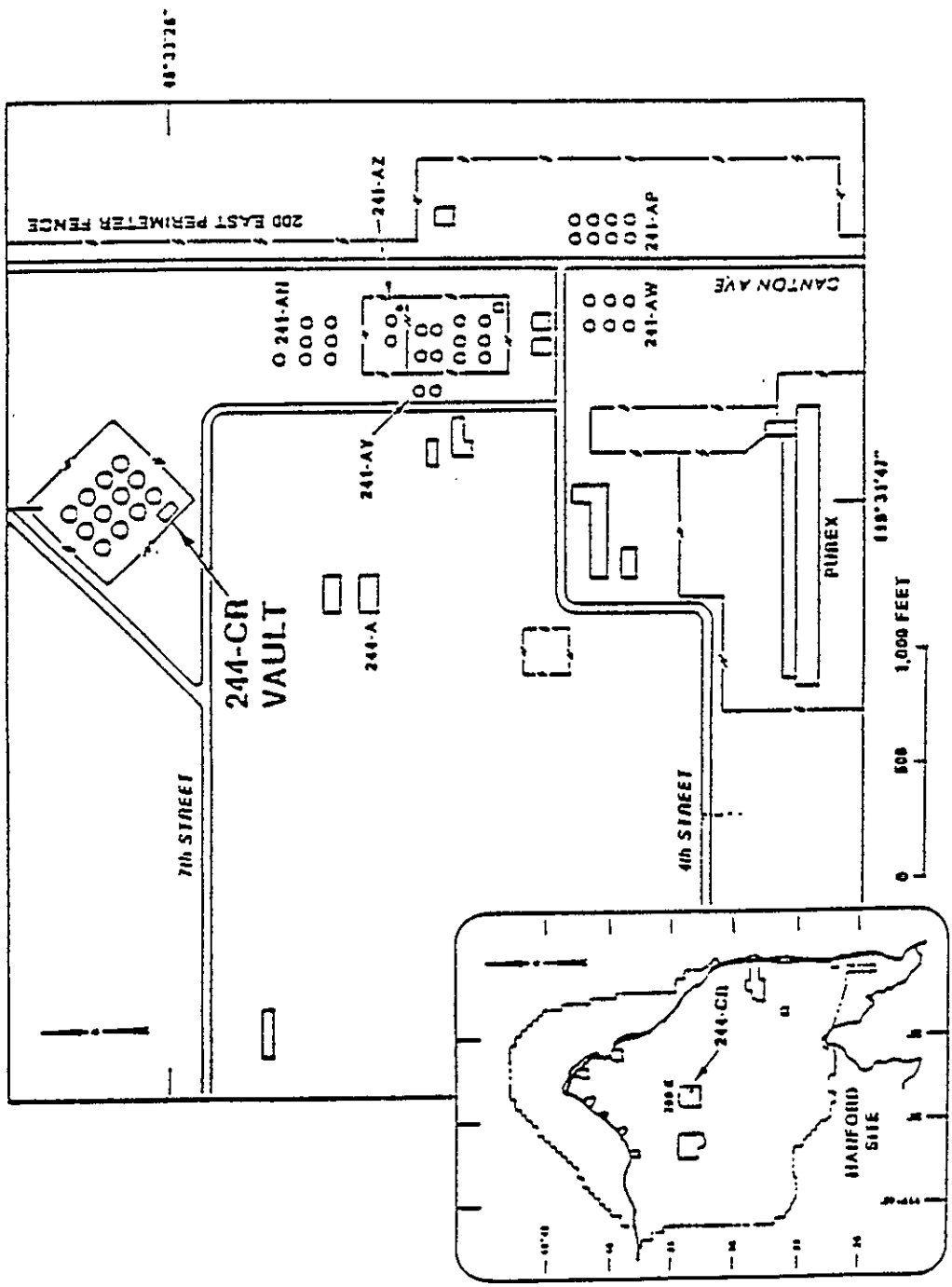


Figure 2-8. 244-CR Vault (Sectional View).

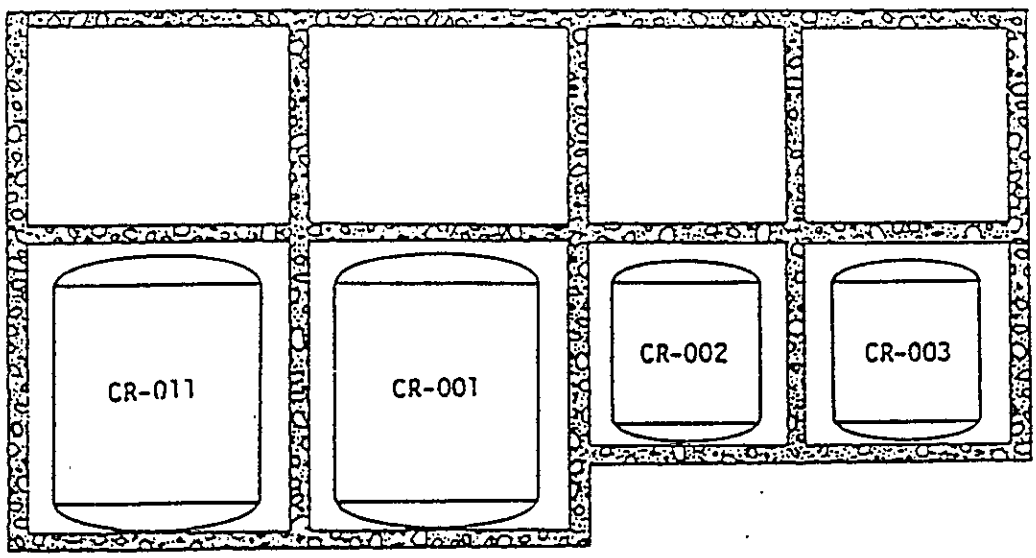
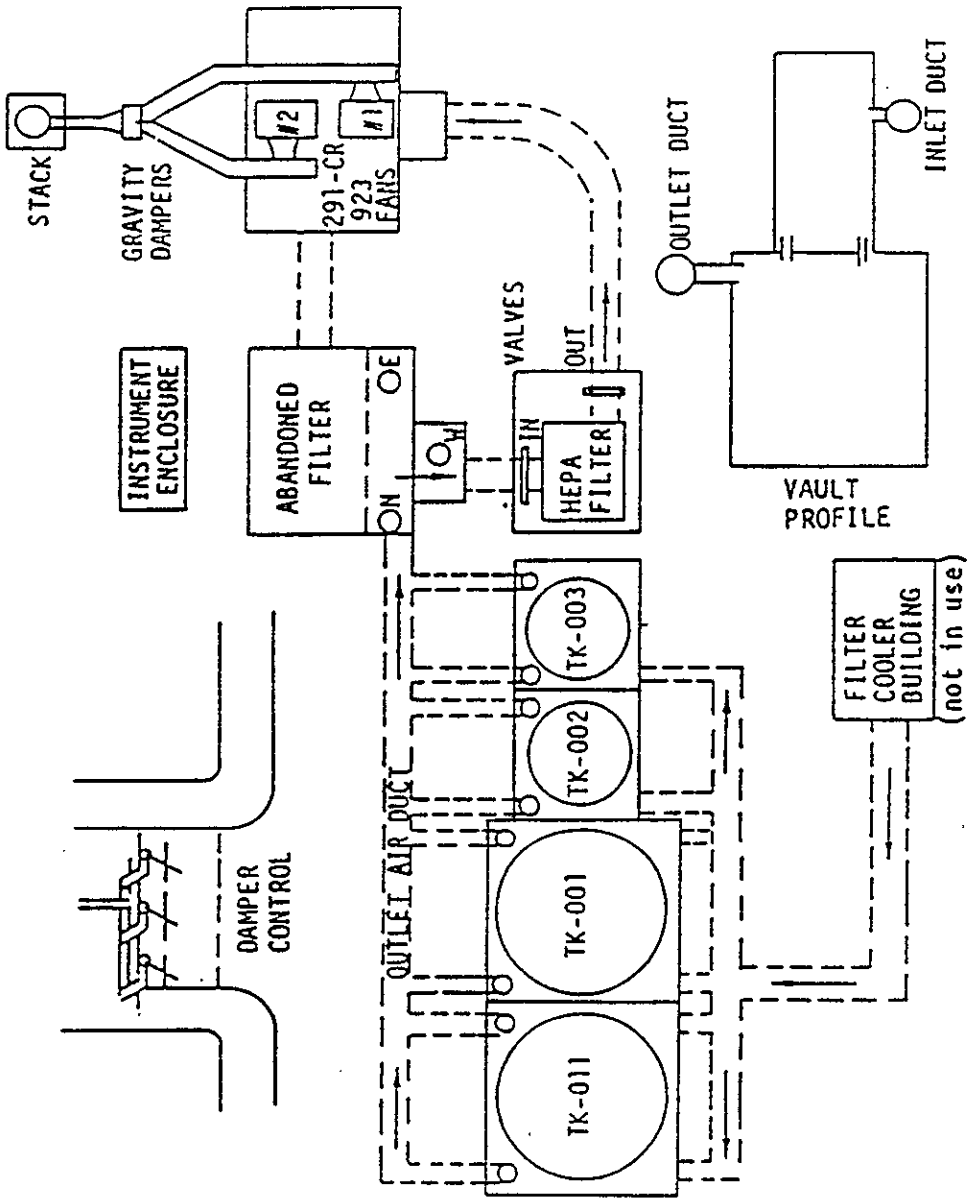


Figure 2-9. 244-CR Vault Ventilation.



2.4.2 Process Description

The original receiver vaults were used for interim storage and processing operations. They can be used to add chemicals, mix solutions, and cool the contents of some of their tanks. The 244-CR Vault is located in the 200 East Area.

The 244-CR-003 tank in the 244-CR Vault may be used as a DCRT for interim storage of salt-well waste from C Farm. Other operating scenarios for this facility have been proposed, but none have been funded.

2.5 DOUBLE-CONTAINED RECEIVER TANKS

2.5.1 Facility Description

The five DCRT systems that are covered in this determination are 244-S Catch Tank, 244-A lift station, 244-TX Catch Tank, 244-U Catch Tank, and the 244-BX Salt Well System. This determination covers the receiver tanks (primary containment), the tank vaults, pump pits, filter pits (all secondary containment), ancillary equipment, and contained piping. The 244-A and 244-BX are located in the 200 East Area. The 244-S, 244-TX, and 244-U are located in the 200 West Area.

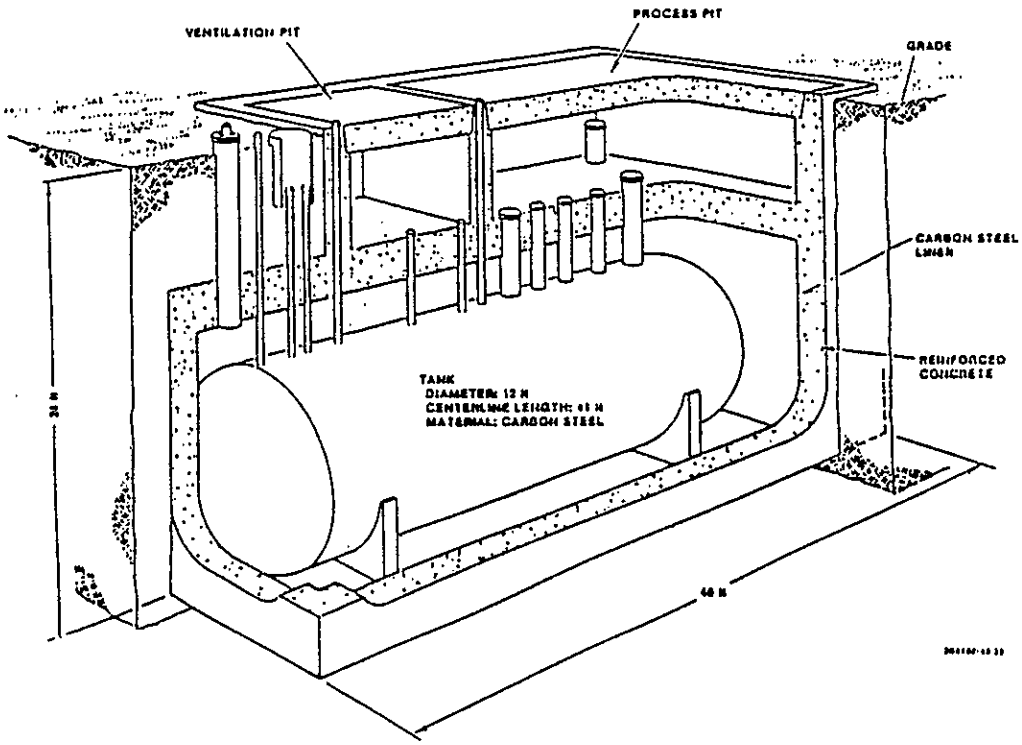
The DCRT systems are used for interim storage of liquid wastes and as valve pits for waste transfer operations. This primarily entails the accumulation of salt well liquors from the SSTs. However, in some cases, the DCRT systems serve as accumulation points for other plant wastes, laboratory wastes, equipment decontamination wastes, and transfer line drainage. These wastes are accumulated in the DCRTs until they are trnasferred to the DSTs. Only the 244-A Lift Station does not collect salt well liquors, but is is used to collect waste during transfers and line drainage.

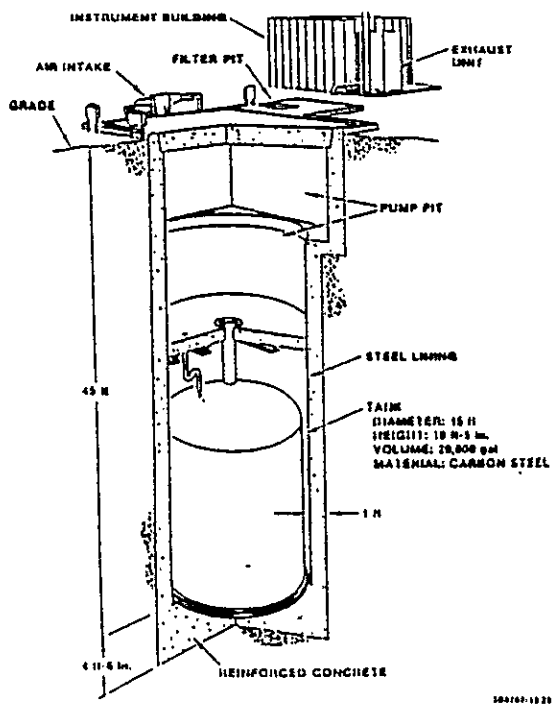
2.5.1.1 244-S Catch Station and 244-A Lift Station. The 244-S Catch Station and 244-A Lift Station are of similar design consisting of a large tank in an underground reinforced concrete structure. The tanks are vertical cylindrical tanks with about 20,000 gal capacity. The 244-S tank is carbon steel and the 244-A tank is stainless steel. The tanks are located in the bottom portion of the cylindrical containment vaults. A schematic of typical DCRTs is shown as Figure 2-10.

The tank vault is 20 ft inner diameter (ID) by 22-1/2 ft outer diameter (OD) to a height of 21 ft 3 in. The tank vault section is separated from the pump pit above by a 12-in.-thick concrete slab. The slab can be removed to permit crane access.

The pump pit area is cylindrical to a height of 12 ft 3 in. The upper 10-ft portion of the pump pit is square, 20 ft by 20 ft, surmounted by 2-ft-thick reinforced concrete cover blocks. The cylindrical sections of 244-S are lined with 1/4-in.-thick carbon steel to the bottom of the pump pit slab. The bottom slab and sump are similarly lined. The tank vault is equipped with a sump, which is fabricated of two pieces of 24-in.-dia. Schedule 40, carbon steel pipe, located on 19-in. centers and 2 ft deep.

Figure 2-10. Examples of Typical Double-Contained Receiver Tanks.





A filter pit, 11 ft square and 11 ft deep with 1-ft-thick reinforced concrete walls, is located adjacent to the upper portion of the pump pit. The filter pit is covered with a 3/8-in. steel plate. The filter pit is plumbed to drain to the receiver tank.

The receiver tank is equipped with a waste transfer pump and instrumentation to measure specific gravity, weight factor, and temperature with the readout in the instrument shelter.

The receiver tank is also equipped with the following 3-in. piping:

- Drains for the pump pit and filter pit
- Two process nozzles for line drainback
- Two spare nozzles, one of which will serve as the sample access.

A 4-in. ventilation line extends from the primary tank to the filter pit.

2.5.1.2 244-BX, 244-TX, 244-U Receiver Tanks. The 244-BX, 244-TX, and the 244-U receiver tanks are horizontal, cylindrical vessels, 12-ft-OD and 35-ft long. The tanks are fabricated of carbon steel and painted on the outside. The following number and size of risers are provided for each tank: one 24-in., three 12-in., one 6-in., four 4-in., seven 3-in., and thirteen 2-in. Each tank is equipped with a waste transfer pump and instrumentation for measuring specific gravity, weight factor, and temperature with readouts at local instrument shelters. The vaults are rectangular and are fabricated of reinforced concrete. Each vault consists of tank vault, pump pit, and filter pit sections. The top of the vault is closed with cover blocks that allow access to the pump and filter pits. A horizontal, cylindrical, 25,000-gal-capacity tank is located in the tank vault. The tank vaults are identical except that 244-TX is lined on the floor and walls to a height of 5 ft with 1/4-in-thick carbon steel. Above 5 ft, the walls are covered by a protective paint (Amercoat*). The floor and wall surfaces of the 244-BX and 244-U vaults are covered by protective paint (Amercoat*).

The tank vaults are 16 ft by 44 ft by 16 ft high and are covered with a 3-ft-thick slab. The slab can be removed to permit crane access. The pump pits are 17 ft by 19 ft; the heights vary. To the top of the cover blocks, the pump pit height is 11 ft 6 in. for 244-BX, 9 ft 11-3/8 in. for 244-U, and 16 ft 1-1/4 in. for 244-TX. The filter pits are 11 ft by 17 ft and the heights vary; the filter pits are the same heights as the pump pits. The cover blocks are 2-ft-thick reinforced concrete.

The tank vaults are equipped with a sump, 6 ft 7 in. by 2 ft by 1 ft deep. The filter pits are plumbed to drain to the 25,000-gal receiver tank.

*Amercoat is a registered trademark of the American Paint Company.

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3.0 SOURCE TERM

3.1 DOUBLE-SHELL WASTE TANKS

3.1.1 Introduction

This section provides the information to determine if a FEMP is required for the DSTs located in tank farms in the 200 East and 200 West Areas.

3.1.2 Identification and Characterization of Potential Source Term

This section provides information for the identification and characterization of the potential source terms associated with the DSTs. The source term information will be compared to information in 40 CFR Part 61 (EPA 1989a) and 40 CFR 302 (EPA 1989b).

The total inventory of waste in nonaging DSTs as of June 1985 was 51,700 m^3. This inventory was a mixture of concentrated wastes that have been processed through the evaporator and dilute waste. The wide range of chemical compositions of the waste contained in DSTs depends on the source and the degree to which the waste has been concentrated. Typical chemical constituents of double-shell slurry and complex concentrate are listed in Table 3-1. The estimated radionuclide inventory for existing waste in DSTs including 241-AY and 241-AZ is presented in Table 3-2.

The upset condition chosen for the DSTs is an over-pressurization event in which all air filtration systems are damaged and the exhausters continue to run for an additional 4 h before shutdown. During this period, tank vapor space air is exhausted to the atmosphere. The exhausted vapor space contaminants would provide a source term as follows:

0.103 Ci ^{90}Sr
0.103 Ci ^{137}Cs
0.000162 Ci ^{241}Am.

These source terms are based on a 4 h release (AP Tank Farm) with no filtration. The AP Tank Farm was used because it has the greatest number of DSTs. These releases equate to 0.0045, 0.0025, and 0.0021 mrem, respectively, and total 0.009 to the maximally exposed offsite individual. This scenario does not include the release of loose material in the ventilation ducts or in the failed filters.

Because this projected dose is below the 0.1 mrem criterion for the maximally exposed individual, a FEMP is not required based on the projected upset condition. Because the AP Tank Farm has the largest projected source term, this determination is valid for the remaining DSTs.

Table 3-1. Typical Compositions of Double-Shell Slurry and Complex Concentrates.

Component	M
Double-shell slurry	
$NaAlO_2$	3.44
NaOH	3.56
$NaNO_2$	5.41
$NaNO_3$	5.66
Na_2CO_3	0.13
Na_3PO_4	0.34
TOC[a] (g/L)	12.75
sp. gr.	1.89
Complex Concentrates	
$NaAlO_2$	0.35
NaOH	1.1
$NaNO_2$	0.5
$NaNO_3$	4.1
Na_2CO_3	1.0
Na_2SO_4	0.1
Na_3PO_4	0.04
$Fe(OH)_3$	0.125
TOC[a] (g/L)	90.0

[a]Total organic carbon.

Table 3-2. Conservative Inventory Estimate of Existing Wastes to be Stored in Double-Shell Tanks (Decayed to the end of 1990).

Radionuclide	Curies
^{241}Am	3 E+04
^{243}Am	3 E+01
^{14}C	4 E+03
^{244}Cm	2 E+02
^{135}Cs	1 E+02
^{137}Cs	2 E+07 (7.4×10^{17} Bq)
^{129}I	4 E+01
^{63}Ni	4 E+04
^{237}Np	6 E+01
^{238}Pu	1 E+01
^{239}Pu	8 E+01
^{240}Pu	2 E+01
^{241}Pu	5 E+02
^{226}Ra	2 E-08
^{106}Ru	1 E+01
^{151}Sm	3 E+05
^{126}Sn	3 E+02
^{90}Sr	2 E+07 (7.4×10^{17} Bq)
^{99}Tc	3 E+04
^{230}Th	1 E-06
^{233}U	5 E-04
^{234}U	4 E-03
^{235}U	2 E+00
^{238}U	4 E+01
^{93}Zr	2 E+02

3.1.3 Effluents

This section describes effluent points of discharge. Both airborne and liquid effluents are listed for DSTs and their ancillary equipment.

3.1.3.1 200 East Area Tank Farms (Excluding Evaporator). The airborne and liquid effluent points for the 200 East Area Tank Farms are as follows:

- Airborne Effluents
  - Stack 296-A-17--241-AY and -AZ Tank Exhaust. Exhausts filtered, noncondensable vapors from waste storage tanks in 241-AY and -AZ Tank Farms
  - Stack 296-A-18--101-AY Tank Annulus Exhaust. Exhausts filtered air from the 241-AY-101 tank annulus
  - Stack 296-A-19--102-AY Tank Annulus Exhaust. Exhausts filtered air from the 241-AY-102 tank annulus
  - Stack 296-A-20--241-AZ Tank Annuli Exhaust. Exhausts filtered air from 241-AZ-101 and 241-AZ-102 tank annuli
  - Stack 296-A-27--241-AW Tank Exhaust. Exhausts filtered air from all 241-AW waste storage tanks
  - Stack 296-A-28--241-AW Tank Farm Annuli Exhaust. Exhausts filtered air from all 241-AW tank annuli
  - Stack 296-A-29--241-AN Tank Exhaust. Exhausts filtered air from all AN tank exhausts
  - Stack 296-A-30--241-AN Tank Farm Annuli Exhaust. Exhausts filtered air from all 241-AN tank annuli
  - Stack 296-A-40--241-AP Tank Exhaust. Exhausts filtered air from all 241-AP waste storage tanks
  - Stack 296-A-41--241-AP Tank Farm Annuli Exhaust. Exhausts filtered air from all 241-AP tank annuli.
- Liquid Effluents
  - AY, AZ Tank Farm Steam Coil Condensate to A8 Crib. Steam coil condensate from the 241-AY and -AZ Tank Farms makes up this intermittent waste stream. Automatic diversion capabilities are provided. This stream was not discharged to the soil column in 1989.
  - 241-A Tank Farm Surface Condenser Cooling Water CA8 to 216-B-3 Pond. Cooling water from the surface condensers for 241-AY and -AZ Tank Farms is collected in this waste stream.

3.1.3.2 200 West Area Tank Farms (Excluding Evaporators). The airborne and liquid effluent points for the 200 West Area Tank Farms are as follows:

- Airborne Effluents
  - Stack 296-P-22--241-SY Tank Farm Annuli Exhaust. Exhausts filtered air from the 241-SY-101, -102, and -103 tank annuli
  - Stack 296-P-23--241-SY Tank Farm Ventilation. Exhausts filtered air from Tanks 241-SY-101, -102, and -103.
- Liquid Effluents - The 200 West Area Tank Farms do not produce liquid effluents.

3.1.4 Determination of Facility Effluent Monitoring Plan Requirements

Attachment 1, the Facility Effluent Monitoring Plan determination form, lists inventory at risk for radioactive and nonradioactive hazardous materials. Projected doses presented in the attachment were calculated with the use of AIRDOSE/RADRISK (CAP-88) (Beres 1990). Projected doses from stack 296-A-40 (241-AP Tank Exhaust) indicates that the criteria for requiring a FEMP for this facility has been met or exceeded.

3.1.5 Summary

Based on the information gathered here, some DSTs (i.e., those served by the 241-AY and -AZ Tank exhaust, the 241-W Tank exhaust, the 241-AP Tank exhaust and the 241-SY Tank exhaust) will require FEMPs because either their potential emissions, or inventories at risk, or both are greater than the criteria.

3.2 SINGLE-SHELL WASTE TANKS

3.2.1 Introduction

This document provides the information to determine if a FEMP is required for the SSTs located in 12 tank farms in the 200 East and 200 West Areas of the Hanford Site.

3.2.2 Identification and Characterization of Potential Source Term

3.2.2.1 Background Information. The source terms are the types and quantities of radionuclides brought into the 204-AR Facility. Waste is received from operations at the 100-N Area, the Hanford Engineering Development Laboratory, and PNL operations at the 300 Area. Tables 3-3 and 3-4 give typical radionuclide contents of waste shipments from the 100 and

Table 3-3. Radionuclide Content of Typical Waste Shipment - Tank Car from 100 Area.

Radioisotope	Total activity Ci	Concentration μCi/me
^{51}Cr	1.3	1.8×10^{-2}
^{59}Fe	1.0	1.3×10^{-2}
^{60}Co	11.0	1.5×10^{-1}
^{95}Zr-Nb	0.1	1.8×10^{-3}
^{103}Ru	0.1	1.3×10^{-3}
^{106}Ru	0.1	8.8×10^{-4}
^{141}Ce	0.3	4.0×10^{-3}
^{144}Ce	0.9	1.2×10^{-2}

Table 3-4. Radionuclide Content of Typical Waste Shipment - Tank Car From 300 Area.

Radioisotope	Activity, Ci		Concentration, μCi/me	
	Filtrate	Solids	Filtrate	Solids
Total Beta	572.0	3,220.0	7.5	4.2×10^{1}
Total Alpha[a]	0.8	2.5	1.1×10^{-2}	3.3×10^{-2}
^{60}Co	<0.4[b]	<3.5[b]	$<6.0 \times 10^{-3b}$	$<4.6 \times 10^{-2b}$
^{90}Sr	23.0	28.0	3.0×10^{-1}	3.6×10^{-1}
$^{106}RuRh$	3.2	30.0	4.2×10^{-2}	4.0×10^{-1}
^{137}Cs	24.0	2.8	3.2×10^{-1}	3.7×10^{-2}

[a] Total alpha calculated as ^{239}Pu
[b] "Less than" is used when the results were below detection level concentration in the shipment

300 Areas. The change in facility missions may change the composition of future waste shipments, however these should represent conservative estimates for current waste shipments. Wastes may also be received from the Fast Flux Test Faciity at the 400 Area.

The other potential source terms come from the nonradioactive hazardous materials used as part of the 204-AR process. As tankers are unloaded, the pH of the waste is adjusted by adding chemicals to meet the specifications for transfer and acceptance in the tank farms. The chemicals used include sodium hydroxide, sodium nitrite, and sodium hydrogen phosphate. The chemicals are prepared and stored in four small tanks. One 500-gal tank holds a 1 lb/gal solution of sodium nitrite. Another 500-gal tank holds a 5.4 molar solution of sodium hydroxide. A 200-gal tank holds a buffer solution of sodium hydrogen phosphate. A 1,800-gal tank holds a 19 molar solution of sodium hydroxide.

As previously stated, these solutions are used to adjust the pH of the waste being unloaded. The only potential release of these materials to the environment is through a process upset. The worst case upset would be a situation in which one of the tanks was accidently drained onto the floor. The tanks are located in the mechanical equipment room and the floor drain connects to the facility catch tank. The catch tank has a capacity of 1,500 gal and sits in a sump with a capacity of approximately 3,000 gal. According to 40 CFR 302.4 Table 302.4 (EPA 1989b) the reportable quantities for sodium hydroxide, sodium nitrite, and sodium phosphate are respectively 1,000 lb, 100 lb, and 5,000 lb. Comparing the reportable quantities, the tank capacities, and potential upset conditions leads to the conclusion that no conceivable upset would result in the loss of a reportable quantity of material to the environment.

3.2.2.2 Radiological Source Term. Two situations result in an airborne radioactive effluent from the 204-AR facility:

- Normal off-loading operations, and
- Upset conditions.

Using the 1989 effluent discharge report (Brown 1990) results for the 296-A-26 Stack the annual dose to the maximally exposed offsite individual can be calculated. A review of the 204-AR SAR (Bixles 1981) reveals that leaking in exposed piping or pumps is the abnormal condition within the probability range (1 to 10 E-02) that meets the definition of an upset.

Discussions with the facility cognizant engineer indicate that approximately 10-15 transfers occurred during 1989. Shipments were accepted from the 100 Area, the 300 Area, and T Plant in the 200W Area. The engineer stated that these shipments were typical for current site activities. The effluent discharge report for 1989 (Brown 1990) reports the annual discharge for the 296-A-26 Stack as $<9.09 \times 10^{-8}$ Ci gross alpha and $<3.09 \times 10^{-7}$ Ci gross beta. The gross alpha is taken to be ^{239}Pu and the gross beta as ^{90}Sr. The estimated release quantities shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facilities operation were otherwise normal (40 CFR 61, Subpart H) (EPA 1987). In order to adjust the annual discharge numbers for the lack of filtration a multiplication factor of 3,000 has been chosen. Therefore, the annual discharge of ^{239}Pu will be 2.71×10^{-4} Ci and the discharge of ^{90}Sr will be 9.27×10^{-4} Ci. According to the PNL release data sheets the annual release of these quantities will result in a dose to the maximally exposed individual of the following:

- 2.39 E-03 mrem CAP-88 (Beres 1990)
- 1.76 E-03 mrem GENII (EPA 1989b).

The other possible situation that could result in the release of radioactive hazardous material to the atmosphere is a process upset consisting of a leak in the exposed piping or pumps. The following discussion describes the consequences of a worst-case piping leak upset. This scenario establishes an upper level boundary for this type of upset condition.

Tank cars of liquid radioactive wastes are received in the 204-AR Facility and connected to the process piping for chemical additions, recirculation mixing, waste transfer to an underground storage tank, flushing, etc. The liquid waste is transferred using a pump capable of delivering 200 gal/min.

It is postulated that a leak in the waste transfer process piping occurs, allowing 10% of the flow (20 gal/min) to be released to the unloading area. It is further postulated that the leak would not be detected for 30 min, during which time up to 600 gal of waste could have leaked from the line. This scenario should be considered worst case for this type of accident. This leak will cause the following events:

- Catch tank sump leak detector and alarm
- Increased catch tank liquid level resulting from receipt of floor drainage
- Increased radiation levels detected by the two area radiation monitoring instruments, with alarms.

These events should alert operations personnel of a problem and trigger early shutdown of the waste transfer operation. No such process piping leaks have occurred during operation of the 204-S Waste Unloading Facility from August 1967 to the present.

Based on the radionuclide content of a typical tank car of 300 Area waste (Table 2-8), this accident could discharge approximately 120 Ci of total beta radioactivity, calculated as ^{90}Sr, and 0.1 Ci total alpha, calculated as ^{239}Pu, to the unloading area catch tank pit area.

Although most of the solution would be expected to drain into the catch tank, a major effort would be required to remove contamination from the walls and floor in the vicinity of the leak. In addition, an estimated 0.1% of the radioactivity (0.12 Ci total beta as ^{90}Sr and 1×10^{-4} Ci total alpha as ^{239}Pu) would become airborne and exit the unloading area via the ventilation exhaust system.

Assuming that the HEPA filters remove 99.95% of this radioactivity (particles $\leq 0.3\mu m$), 6×10^{-5} Ci of total beta as ^{90}Sr and 5×10^{-8} Ci of total alpha as ^{239}Pu, would be released to the atmosphere through the 296-A-26 Stack. This results in an offsite dose to the maximally exposed individual of the following:

- 2.36 E-06 mrem GENII (EPA 1989b)
- 3.06 E-06 mrem CAP-88 (Beres 1990).

Under the conditions of routine releases with no credit taken for filtration and the most severe upset condition, the resulting dose to the maximally exposed offsite individual does not approach the 0.1 mrem requiring a FEMP.

3.2.3 Potential Effluents

3.2.3.1 Potential Gaseous Radioactive Effluents. The only routine gaseous effluents anticipated are associated with the three active ventilation systems in Tank Farms A, SX, and C. The measured emissions of calendar year (CY) 1989 (Schmidt et al., 1990) are listed in Table 3-5.

Routine gaseous effluents are not anticipated with the passive breather filters used for most SSTs. Some small, noncontinuous, convective flow would be induced by the decay heat from the radionuclides in the tank. Changes in barometric pressure would induce periodic flows into and out of the tank. The diurnal heating of the ambient atmosphere around the tank would further induce flow into and out of the tanks. Environmental sampling results of the tank farms indicate that these sporadic emissions have not increased the level of airborne contaminants in these areas to any level of concern (Schmidt et al. 1990).

3.2.3.2 Potential Nonradioactive Gaseous Effluents. Under the alkaline conditions of the SSTs, almost all the ammonium/ammonia present in the waste is found in the form of dissolved ammonia gas. Small but unquantified quantities of ammonia have been emitted from the waste in some DSTs and have led to the formation of ammonium nitrate via a gas-phase reaction. The highest ammonia concentrations, 7.8 mol%, are postulated for the DSTs used to store PUREX neutralized cladding waste; the vapor phase concentrations in the SSTs are lower.

The exceptions are tanks 241-C-102 and -103. Both organic vapors and ammonia have been measured in the headspace of both tanks (Trent 1990). Calculations indicate that neither flammable concentrations of the organic vapors are achieved in the tank headspace under static conditions (passive breather) nor are reportable quantities of organic vapor or ammonia vented under these conditions (Trent 1990, Tranbarger 1990, Bramson 1990, Tranbarger 1990).

3.2.3.3 Potential Radioactive Liquid Effluents. Liquid effluents are only generated by systems using active ventilation, which is process condensate for all three active ventilation systems (A Tank Farm, primarily 241-A-105,

Table 3-5. 1989 Measured Emissions.

	Gross alpha, Ci	Gross beta, Ci
200 East Area		
Exhauster 296-P-16, 241-C-105, -106	<6.38 E-8	<3.35 E-6
Exhauster 296-P-17, 241-A-105	3.86 E-8	2.18 E-6
200 West Area		
Exhauster 296-S-15 SX Tank Farm	<2.33 E-7	<7.99 E-7

241-C-105 and -106, and SX Tank Farm except 241-SX-113 and -115), and the steam condensate from the heater in the SX system. All liquid effluents have some potential for radioactive contamination. If formed, the process condensate occurs in air exhaust ducts, which certainly have some radioactive surface contaminants that could be carried with the liquid. If leaks occur in the steam heating coils in the SX exhauster, the tendency would be to expel steam and liquid into the exhaust system; even so, the migration of small amounts of radioactive surface contaminants cannot be precluded. Thus, it would appear that liquid effluents have the potential to contain radioactive contaminants.

3.2.3.4 Potential Nonradioactive Liquid Effluents. If a reasonable potential exists for the contamination of any liquid effluents generated in the three active SST ventilation systems described, the liquids will also be contaminated with the principle chemical compounds found in SST waste: sodium nitrate, nitrite, hydroxide, aluminate, carbonate, etc. The concentrations will be very small and limited by the exposure resulting from the radionuclide content.

3.2.4 Waste Characteristics

The high-level wastes from various Hanford Site activities have been combined and mixed; portions have been reprocessed. The composition of the residues is not chemically or radioactively uniform. A limited number of core samples of some SSTs have been analyzed. Neither the radionuclide nor chemical inventory has been accurately characterized.

Currently, the 149 SSTs hold approximately $3.7 \times 10^{+7}$ gal of waste. The total volumes of liquid, sludge, and saltcake stored are $6.5 \times 10^{+6}$ gal, $1.3 \times 10^{+7}$ gal, and $2.4 \times 10^{+7}$ gal, respectively (Hanlon 1990). The inventory of radionuclides in each tank has been estimated using the Track Radioactive Components (TRAC) code (Jungfleish 1984). The TRAC code has limited validation against sample assays of tank contents and may diverge from actual values by an order of magnitude in some cases (Jungfleisch 1984).

In general, the Hanford Site defense waste consists chiefly of sodium salts (e.g., nitrate, nitrite, aluminate, hydroxide, carbonate, phosphate) and the hydrous oxides of iron and manganese. An estimate of the volume of these components by tank farm can be found in ERDA (1975). The typical SST waste composition with ammonia added is:

water	1.0 L
ammonia	0.3 mol
sodium hydroxide	3.5 mol
sodium nitrate	4.3 mol
sodium nitrite	2.3 mol

Some tanks may contain substantial quantities of organic compounds and heavy metals.

3.2.5 Determination of Facility Effluent Monitoring Plan Requirements

3.2.5.1 Radioactive Contamination of Gaseous Effluents.

3.2.5.1.1 Passive Breather Systems. The most probable failure of SSTs equipped with passive breather systems, loss of the seal loop fluid, would cause the contaminated atmosphere in the SSTs to vent to the ambient environment. The consequences of this failure were evaluated. The assumptions were:

- The atmosphere is vented for 8 d (the seal loop fluid is checked weekly)
- The atmosphere is vented at the rate of 8 ft^3/min (conservative for the diameter piping used and the potential differential pressures)
- The radionuclide concentrations listed in Table 3-6.

The projected dose for the maximally exposed offsite member of the public was estimated at 2.0×10^{-7} rem whole body for a 1-yr commitment period. The exposure is less than the 0.1 mrem criteria for requiring a FEMP.

Using other more realistic assumptions, such as loss or bypass of the emission control devices and venting of the headspace gases by natural mechanisms (uncontrolled release), results in even lower exposures for the maximally exposed offsite individual. The HEPA filters are checked for particle capture efficiency at least every 6 mo (WHC 1988). Over such an extended period, a continuous flow of 8 ft^3/min appears unrealistic. The flow depends on barometric pressure and temperature differentials between the ambient and tank atmospheres. The flows would equilibrate slowly because of the small pressure differential that could be imposed and the pressure drops through the system (e.g., HEPA filter, small diameter piping connecting the HEPA filter, and tank atmosphere). Flow would be in opposite directions for almost equal periods. Therefore, it is assumed that the out-flow average would be 0.1 ft^3/min. The flow is 1/80 of that assumed in the scenario for 180 d versus 7 d or 25.7 times longer. The dose is calculated to be $1/80 \times 25.7 = 0.32$ of that estimated, or 6.4×10^{-8} rem to the maximally exposed individual. For the situation where the gaseous emissions are released without controls, the emissions and the resultant dose from the loss of HEPA filter evaluated above is doubled. Under these conditions, the dose to the maximally exposed member of the public is projected to be 1.3×10^{-4} mrem.

3.2.5.1.2 Active Ventilation Systems. The SSTs in Tank Farms A, C, and SX have active ventilation systems as described in Sections 2.2.2.1.1, and 2.2.2.1.2. The consequences of the loss of filtration with the exhaust blower operating was described in subsection 9.3.1.3 of Prosk and Smith (1986). The scenario is for an accident condition and postulates the loss of both HEPA filters for 4 h. An abnormal operation is the loss of a single barrier with a probability of greater than 1×10^{-2} y, the probability assigned to this event by the authors. The release of radionuclides would be four times the values shown in the table for an active system. Two maximum offsite doses were evaluated, a person on Highway 240 (4.5 km from the release point) and a

Table 3-6. Single-Shell Tank Source Terms Unfiltered Release, Ci/h.

	Active ventilation	Passive ventilation	
		8 cfm	0.1 cfm
^{14}C	2.3 E-6	-	-
^{90}Sr	4.6 E-2	3.3 E-5	4.1 E-7
^{95}Zr	4.6 E-6	-	-
^{99}Tc	2.3 E-6	1.6 E-8	2.1 E-10
^{106}Ru	2.3 E-8	1.0 E-11	1.3 E-13
^{126}Sn	4.6 E-7	3.8 E-10	4.8 E-12
^{129}I	4.6 E-9	8.8 E-11	1.1 E-12
^{135}Cs	9.1 E-9	5.3 E-11	6.6 E-13
^{137}Cs	2.3 E-3	1.2 E-5	1.5 E-7
^{151}Sm	4.6 E-4	4.2 E-7	5.3 E-9
^{226}Ra	2.3 E-17	2.4 E-20	3.0 E-22
^{230}Th	4.6 E-15	6.0 E-18	7.5 E-20
^{233}U	1.8 E-12	3.1 E-15	3.9 E-17
^{234}U	2.3 E-11	6.6 E-14	8.2 E-16
^{235}U	2.3 E-9	7.3 E-12	9.1 E-14
^{238}U	9.1 E-8	1.7 E-10	2.2 E-12
^{237}Np	1.8 E-9	3.1 E-10	3.9 E-12
^{238}Pu	2.3 E-7	7.1 E-10	8.9 E-12
^{239}Pu	1.4 E-5	1.3 E-8	1.6 E-10
^{240}Pu	2.3 E-6	2.9 E-9	3.7 E-11
^{241}Pu	2.3 E-5	3.8 E-8	4.8 E-10
^{241}Am	2.3 E-5	3.8 E-8	4.8 E-10
^{243}Am	2.3 E-8	2.0 E-11	2.5 E-13
^{244}Cm	1.4 E-7	9.9 E-11	1.2 E-12

person residing 12.5 km from the release point. The 1-yr whole body dose commitment estimated for these maximally exposed offsite individuals were 0.76 mrem and 0.73 mrem respectively. Back calculation of the active ventilation volumetric flow rate assumed for the scenario indicates a value of approximately 4,850 ft^3/min. Although this value exceeds the flow rate for the A and C systems and is less than the SX system, the differences do not result in any significant change in the dose calculated for the event. The 0.1 mrem criteria is exceeded, indicating that SSTs with active ventilation systems require a FEMP.

3.2.5.2 Emission of Hazardous Waste in Gaseous Emissions.

3.2.5.2.1 Passive Breathers. In SSTs with passive breathers, the nonvolatile hazardous materials and radioactive materials present in the waste are intermingled. Based upon the total activities released and the concentrations of radionuclides in the waste (Jungfleisch 1984), the total mass of waste released is gram quantities. Thus, the quantities of wastes released are well below any reportable quantities for the nonvolatile hazardous waste.

The release of volatile components (organic vapors and ammonia) from tanks 241-C-102 and -103 has been previously covered and are below RQs or permitted concentrations.

3.2.5.2.2 Active Ventilation. As described above, the quantities of hazardous materials that could be released are well below RQs for the hazardous materials involved.

3.2.5.3 Release of Radioactive Contaminants in Liquid Effluents.

3.2.5.3.1 Passive Breathers. By the common definition for an effluent (materials routinely emitted by a process or system via some well-defined path), SSTs equipped with passive breathers do not have liquid effluents. At a minimum, all piping except that associated with removing residual liquid has been disconnected. Active ventilation is required for the wastes with high heat generation that could generate moisture. Without active ventilation to carry moisture into the ventilation ducts, condensate cannot form. Condensate is not anticipated for SSTs equipped with passive breathers.

Some SSTs with and without active ventilation systems have lost containment and leaked. Approximately 45% (66 of 149) of all SSTs are currently listed as "assumed leakers." The leaking SSTs are spread throughout all tank farms and are independent of age or design (roughly 50% of the most recently constructed SSTs (A and AX Tank Farms) are designated as assumed leakers.

Leakers release large volumes of liquids. Table G-1 of Hanlon (1990) estimates the volumes of liquids is from 115,000 gal (241-T-106, 1973) to less than reportable values (241-T-108, -T-111, -TY-101, -T-103, -T-109). These estimates do not include cooling water sprayed on the surface of 241-A-105 (5,000 gal, 1963) that may have been drained to the soil under the tank. Although not evaluated, the quantities of radionuclides and hazardous materials released probably exceed the FEMP criteria.

Although the failure frequency for the SSTs fits the criteria for an abnormal event, 1 x 10^{-2}/yr, a leaker represents the complete loss of containment and would not be considered an upset condition. Furthermore, the path of the liquid released cannot be defined before the fact because the location of the leak cannot be predicted. Monitoring and control of such releases have not been addressed (BAT). Other techniques currently employed are used to detect and evaluate the liquid volume released. Therefore, for the purposes of these analyses, SST leaks are not considered liquid effluents.

3.2.5.3.2 Active Ventilation Systems. All SSTs with active ventilation systems have process condensates. The moisture released from the liquid in the waste at elevated temperatures condenses on the cool surfaces of the ventilation ducts and drains back into the SST. Any surface contamination on the ducts is anticipated to be picked up by the process condensates. Therefore, any process condensate that is lost from the ducts potentially carries radionuclides to the soil; the system would require a FEMP.

Furthermore, the condensate from the steam coils in the SX system could carry radionuclides to the crib if the coils lose integrity. This condition also would categorize the SX system as requiring a FEMP.

3.2.5.4 Release of Hazardous Materials in Liquid Effluents.

3.2.5.4.1 Passive Breathers. For the purposes of these analyses, SSTs equipped with passive breathers do not generate liquid effluent.

3.2.5.4.2 Active Ventilation Systems. The anticipated quantity of waste carried to the ventilation system is small. The radionuclides and hazardous wastes are intermingled and if the release level was significant, the radiation level in the ventilation systems would be detected. Therefore, the amount of hazardous wastes that could be carried by the liquid effluents is assumed to be small and would not exceed RQs.

3.2.6 Summary

Based on the information gathered here, the 11 SSTs served by the 3 active ventilation systems (A, C, and SX) will require FEMPs because of their potential emissions of radionuclides in their gaseous and liquid effluents. Attachment 1 provides specific information on inventories at risk used to determine the requirement for FEMPs.

3.3 204-AR WASTE UNLOADING FACILITY

3.3.1 Introduction

This document provides information to determine if a FEMP is required for the 204-AR Waste Unloading Facility.

3.3.2 Potential Effluent Streams

3.3.2.1 Airborne Effluent. A schematic diagram showing the HVAC flow paths and flow rates is presented in Figure 3-1.

The airflow systems ventilate the 204-AR Facility. The noncontaminated areas are supplied and serviced by HVAC equipment, handling a mixture of recirculated and outside air. Air temperature is controlled by heating and cooling thermostats acting in conjunction with a system selector switch. The toilet exhaust fan, EF-2, is interlocked to start up with the HVAC recirculating fan; shutdown or failure of the unloading area exhaust fan, EF-1, will automatically prevent operation of EF-2.

The unloading area is heated by two electric heaters suspended from the ceiling, which maintain a minimum temperature of 40 °F. No air conditioning is provided. The heater fans destratify the unloading area atmosphere to minimize "dead" spots. Potentially contaminated and contaminated unloading area air is exhausted through two HEPA filters in series by exhaust fan EF-1 and released into the atmosphere. The exhaust fan maintains a negative pressure in the unloading area with respect to the outside atmosphere, except when the doors are open to receive or remove a car. The release point is Stack 296-A-26-204-AR.

Two manually adjusted dampers regulate the exhaust flows from the change room and the tank car unloading area. Two motor-operated dampers open or close the outside air intake to the mechanical equipment room; the EF-1 fan discharges to the stack. Failure of EF-1 is indicated by loss of suction pressure and is annunciated in the operations room and at 242-A.

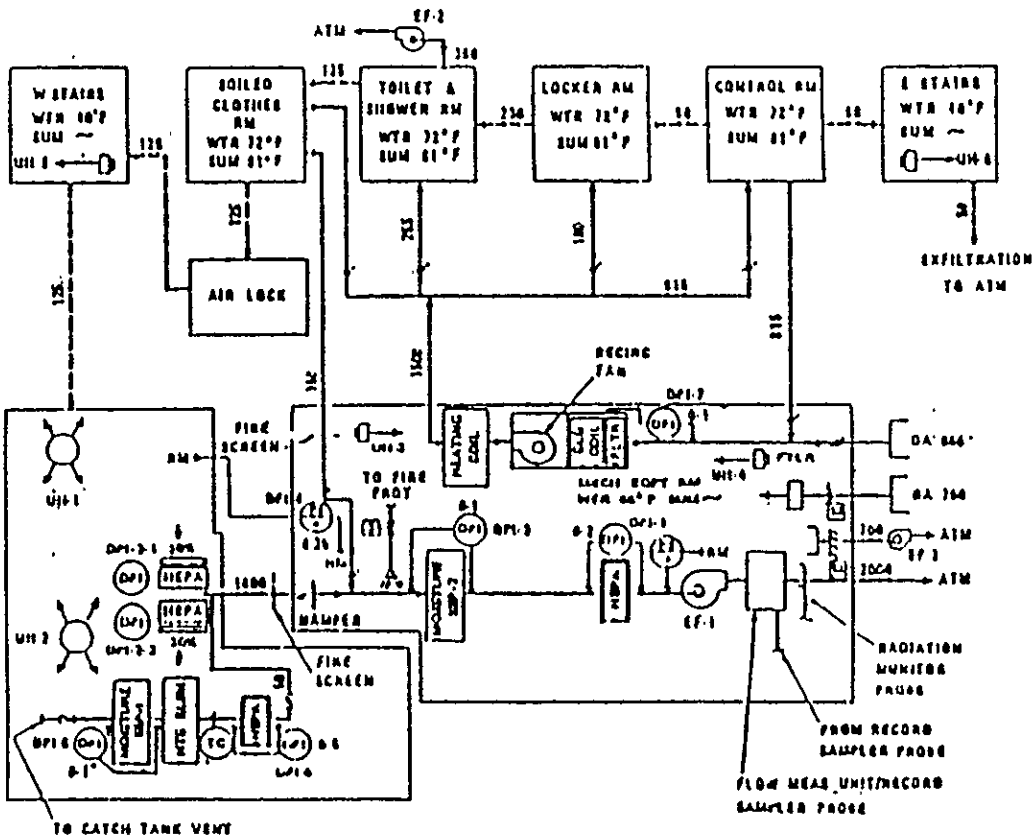
Air is supplied to the change room from the recirculating fan, and air from the change room is exhausted through the HEPA filtering system by EF-1.

Air from the catch tank vent is drawn through a moisture separator, a heating element, a HEPA filter (HSG-3), and then into the main HEPA filtering system (ahead of HSG-2 filter) by EF-1. The filter housing, moisture separator, and the inlet line and valves in the system are made of stainless steel. The moisture separator can be flushed with water. Butterfly isolation valves take the unit out of service to change filters.

The mechanical equipment room is heated by two electric space heaters and maintained at a minimum temperature of 65 °F. Air is exhausted from the room directly to the atmosphere without HEPA filtration by the EF-3 exhauster. The fan is controlled by a switch in the room. The EF-3 exhaust fan in the mechanical equipment room is operated only under controlled conditions for special functions, such as chemical makeup. Air from this space would not normally contain any hazardous material, and therefore is not considered an effluent point of concern.

The galvanized ductwork leading from the unloading area and the catch tank to the HEPA filters on the suction side of EF-1 is monitored with portable radiation instruments to detect any contamination buildup.

Figure 3-1. Heating, Ventilation, and Air Conditioning Flow Chart.



The primary effluent point for airborne release of hazardous materials is the 296-A-26 Stack. The effluent is the result of normal tanker off-loading activities and consists primarily of radioactive gases and particulates.

3.3.2.2 Liquid Effluent. Any liquid from the tank car, process piping, and/or decontamination solutions drains to the floor and is collected in a stainless steel drain system. The system drains to a 1,500-gal catch tank enclosed in a stainless steel-lined concrete pit (see Figure 2-6). The pit has a 3,050-gal capacity; the pit and catch tank have a 4,550-gal capacity. Liquid removal equipment is provided for the catch tank and the catch tank pit sump in case of a leak or overflow from the catch tank. Administrative procedures require this system to be pressure checked for leakage, minimizing the probability of an accidental release of contaminants into the soil from a leak under the building.

An interlock system for overflow protection in the 204-AR Facility protects the tank car, catch tank, and sump from potential overflow conditions.

A "high-level" alarm relay, activated by high liquid levels in the tank car or catch tank or by the sump leak detector, closes six motor-operated valves. With these valves closed, all water, chemical, and waste streams to the tank car, catch tank and sump are stopped. This protection also prevents contents from siphoning out of the tank car dip leg or into the catch tank via the sample system or the tank car sluicer.

Waste is pumped to the tank farm via the 241-A-A Valve Pit. From the 241-A-A Valve Pit, the solution is routed directly to a DST. The underground waste line from the 204-AR Facility is a pipe-in-pipe arrangement for leak containment.

Sanitary wastes from the restroom, showers, and drinking fountains are discharged into a septic tank and tile field. These effluent sources are not considered to be contaminated with hazardous materials. All other liquid wastes generated by operation of the 204-AR Facility are routed to underground waste storage tanks for subsequent processing in 242-A.

No liquid effluent streams containing regulated hazardous material result from the facility processes.

3.3.3 Determination of Facility Effluent Monitoring Plan Requirements

Attachment 1 lists the inventory at risk for radioactive materials at the 204-AR Waste Facility. Information on specific radionuclides, physical and chemical forms, quantities released (with and without emission controls), and projected doses (without controls) is given.

Liquid effluents are not considered to be contaminated with hazardous materials. All other liquid wastes generated by operation of the facility are routed to underground waste storage tanks for subsequent processing in 242-A.

The only identified gaseous radioactive effluent to the environment is through the 296-A Stack. Calculations performed (Attachment 1) show no routine or credible upset conditions that could result in the release of an amount of material that would produce offsite doses that exceed the FEMP requirement criterion.

3.3.4 Summary

The only identified effluent stream to the environment is via the 296-A-26 Stack. No liquid effluent streams result from normal processes. No credible upset conditions exist that would result in the release of radioactive liquids to the environment. Based on the nonradioactive hazardous materials in use, their storage locations, concentrations, and 40 CFR 302.4 (EPA 1989b) RQs, no credible upset conditions exist that could result in the release of a RQs of material.

The two conditions of concern are the yearly routine airborne releases and an upset condition resulting in an airborne release. Calculations detailed above have showed that offsite doses resulting from these two conditions do not approach the 0.1 mrem EDE limit established by regulation as requiring a FEMP.

The conclusion of this report is that the 204-AR Waste Unloading Facility does not need a FEMP.

3.4 244-CR VAULT

3.4.1 Introduction

This document provides information to determine if a FEMP is required for the 244-CR Vault. This document has been prepared in accordance with the Guide (WHC 1991).

3.4.2 Identification of Inventory at Risk

Because the primary purpose of reactivating the 244-CR Vault is to remove interstitial liquid from tanks in the C Tank Farm, the potential inventory at risk is the tank liquid that is likely to be removed from the tank farm.

3.4.2.1 C Tank Farm. The C Tank Farm was one of four tank farms constructed in 1943-44 and shares physical characteristics and arrangement with T, U, and B Tank Farms. The tank farm has been used to support a number of operations. tanks 241-C-101 through -106 were used to store metal waste and -107 through -112 were used to store first-cycle B Plant decontamination wastes beginning in March 1946. In 1953, the waste stored in the first cascade (Tanks 241-C-101 through -103) was removed and the tanks were converted to receiver tanks for the TBP process. Other tanks in the farm were also used as feed and receiver tanks for fission-product waste processing from the PUREX Plant in the 244-CR Waste Vault. This processing left large quantities

of ^{90}Sr in Tanks 241-C-105 and 241-C-106 (as of 1985, Tank 241-C-106 contained the highest heat load of SSTs - 183,000 Btu/h by psychometric data). Tanks 241-C-103, -104, and -107 also received insoluble strontium-leached sluicing solids from the operations in the 244-CR Waste Vault.

Currently, 14 tanks in C Farm contain noncomplexed waste. One (241-C-104) holds complexed waste [dilute waste material containing relatively high concentrations of chelating agents (e.g., EDTA, HEDTA) from B Plant waste fractionization operation], and one is listed as empty (241-C-202). Seven of the tanks are assumed leakers. Nine of the SSTs in this farm have been interim stabilized, eight have been interim isolated, and the other eight are partially interim isolated. The volume of drainable liquid in the tanks ranges from 0 (5 tanks) to 48,000 gal (241-C-102 and -106). The farm is currently estimated to contain a total of 224,000 gal of drainable liquid (Hanlon 1990).

3.4.2.2 Waste Characteristics. The high-level wastes from various Hanford activities have been combined and mixed; portions were reprocessed. The composition of the residues is not chemically or radioactively uniform. A limited number of core samples of some SSTs have been analyzed. Neither the radionuclide nor chemical inventory has been accurately characterized.

Currently, the 149 SSTs hold approximately $3.7 \times 10^{+7}$ gal of waste. The total volume of liquid, sludge, and saltcake stored are $6.5 \times 10^{+6}$ gal, $1.3 \times 10^{+7}$ gal, and $2.4 \times 10^{+7}$ gal, respectively (Hanlon 1990). The inventory of radionuclides in each tank has been estimated using the TRAC code (Jungfleisch 1984). The TRAC code has limited validation against sample assays of tank contents and, according to the author, may diverge from actual values by an order of magnitude in some cases.

In general, the Hanford Site defense waste consists chiefly of sodium salts (e.g., nitrate, nitrite, aluminate, hydroxide, carbonate, phosphate) and the hydrous oxides of iron and manganese. An estimate of the volume of these components by tank farm can be found in Energy Research and Development Agency (ERDA) (1975). The typical SST waste composition with ammonia added is as follows:

water	1.0 L
ammonia	0.3 mol
sodium hydroxide	3.5 mol
sodium nitrate	4.3 mol
sodium nitrite	2.3 mol.

Some tanks may contain substantial quantities of organic compounds and heavy metals.

3.4.3 Potential Effluent Streams

Normal facility operation and upset conditions result in airborne effluents, via the vault ventilation system, out Stack 296-C-5-CR. As a byproduct of ventilation operation a liquid effluent (under certain meteorological conditions) consisting of stack condensate results. No other routine or upset liquid effluents are associated with the facility.

Discussions with the facility cognizant engineer indicate that the stack condensate effluent is routed to a French drain that empties directly to the soil column. This effluent is known to be contaminated and the presence of this stream would normally necessitate the preparation of a FEMP. However, a work package (2E-90-3589) is in progress to provide an above-ground catch tank. Completing the catch tank will eliminate this effluent stream. For purposes of this determination, this stream will be considered eliminated and not be considered in this determination.

3.4.4 Identification and Characterization of Potential Source Term

3.4.4.1 Potential Gaseous Radioactive Source Terms. The only routine gaseous effluents anticipated are associated with the three active ventilation systems. The measured emissions for CY 1989 (Brown 1990) are the following:

	Gross Alpha, Ci	Gross Beta, Ci
296-C-5 Stack	<8.98 E-08	<1.90 E-06

However, although the ventilation system has been active, the vault has only been used to transfer waste once or twice in the last several years. Therefore, these measured emissions are probably not representative of routine emissions during facility operation.

From the CY 1989 effluent discharge report, the gross alpha is taken to be ^{239}Pu and the gross beta as ^{90}Sr. Title 40 CFR 61, Subpart H (EPA 1987) specifies that the estimated release quantities shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facilities' operation was otherwise normal. To adjust the annual discharge numbers for the lack of filtration, a multiplication factor of 3,000 has been chosen. To compensate for the fact that the facility was not operational during 1989, the readings will be adjusted by another factor of 10. As a result, the annual discharge with no filtration will be 2.69×10^{-03} Ci of ^{239}Pu and 6.0×10^{-02} Ci of ^{90}Sr. With these assumptions, the dose to the maximally exposed offsite individual is projected to be:

CAP-88	0.02 mrem
GENII	0.02 mrem.

These values are less than the 0.1 mrem criterion that would require a FEMP.

Another possible situation that could result in the release of radioactive hazardous material to the atmosphere is a process upset consisting of a leak in the exposed piping or tank. This could result in a pool of liquid waste in the bottom of a vault cell. The following discussion describes the consequences of a worst-case piping leak upset. This scenario establishes an upper-level boundary for this type of upset condition.

The source term for this upset condition would be produced by venting the contaminated atmosphere of the vault. Venting the contaminated atmosphere in a SST to the ambient environment has been evaluated. The radionuclide concentrations assumed for the SST venting are listed in Table 3-7.

The active ventilation in a SST is assumed to produce a flow of about 4,850 ft^3/min and the 244-CR ventilation produces a flow of about 4,200 ft^3/min. However, the SST ventilation is taken from the enclosed air space above the contained liquid. The vault ventilation path could expect concentrations for active ventilation that are greater than those listed above by a factor of 10. A review of the above list shows that the nuclides of consequence are ^{90}Sr, ^{137}Cs, and ^{239}Pu. For this evaluation, it is assumed that it would take approximately 10 h for a leak to be discovered and for the liquid to be pumped from the cell sump back into a tank. It is further assumed that the HEPA filtration is 99.9% efficient, providing a reduction factor of 1,000. The resulting release for this upset condition would be 4.6×10^{-03} Ci ^{90}Sr, 2.3×10^{-04} Ci ^{137}Cs, and 1.4×10^{-06} Ci ^{239}Pu. This results in a dose to the maximally exposed offsite member of the general public of the following:

CAP-88	2.2 E-04 mrem (Beres 1990)
GENII	1.7 E-04 mrem (EPA 1989b).

This exposure is less than the 0.1 mrem criterion for requiring a FEMP.

3.4.4.2 Potential Nonradioactive Gaseous Source Terms. Under the alkaline conditions in the SSTs, almost all the ammonium/ammonia present in the waste is found in the form of dissolved ammonia gas. Small but unquantified amounts of ammonia have been emitted from the waste in some DSTs and have led to the formation of ammonium nitrate via a gas-phase reaction. The highest ammonia concentrations, 7.8 mol%, are postulated for the DSTs used to store PUREX neutralized cladding waste. Based on the RQs listed in 40 CFR 302.4 (EPA 1987) for the hazardous materials present in the waste (lowest value 100 lb for ammonia and sodium nitrite) and the extremely small amounts that could be present in gaseous effluents during routine operations or during an upset condition, release of a RQs in one year is not credible.

3.4.4.3 Potential Radioactive Liquid Source Terms. As mentioned above, the process condensate, if formed, occurs in the air exhaust duct. The duct has some radioactive surface contaminants that are carried with the liquid. As mentioned earlier, the installation of a stack catch tank will eliminate this effluent path.

Any liquid losses caused by piping or tank leaks within the facility would be retained within the vault system; these losses would be returned to the tanks via the cell sumps. No credible upset conditions were identified that would result in a liquid release to the environment.

3.4.4.4 Potential Nonradioactive Liquid Source Terms. If a reasonable potential existed for the creation of any liquid effluents, the liquids would most likely be contaminated with the principle chemical compounds found in SST

Table 3-7. Single-Shell Tank Source Terms Unfiltered Release, Ci/h.

		Passive ventilation	
	Active ventilation	8 ft^3/min	0.1 ft^3/min
^{14}C	2.3 E-6	-	-
^{90}Sr	4.6 E-2	3.3 E-5	4.1 E-7
^{95}Zr	4.6 E-6	-	-
^{99}Tc	2.3 E-6	1.6 E-8	2.1 E-10
^{106}Ru	2.3 E-8	1.0 E-11	1.3 E-13
^{126}Sn	4.6 E-7	3.8 E-10	4.8 E-12
^{129}I	4.6 E-9	8.8 E-11	1.1 E-12
^{135}Cs	9.1 E-9	5.3 E-11	6.6 E-13
^{137}Cs	2.3 E-3	1.2 E-5	1.5 E-7
^{151}Sm	4.6 E-4	4.2 E-7	5.3 E-9
^{226}Ra	2.3 E-17	2.4 E-20	3.0 E-22
^{230}Th	4.6 E-15	6.0 E-18	7.5 E-20
^{233}U	1.8 E-12	3.1 E-15	3.9 E-17
^{234}U	2.3 E-11	6.6 E-14	8.2 E-16
^{235}U	2.3 E-9	7.3 E-12	9.1 E-14
^{238}U	9.1 E-8	1.7 E-10	2.2 E-12
^{237}Np	1.8 E-9	3.1 E-10	3.9 E-12
^{238}Pu	2.3 E-7	7.1 E-10	8.9 E-12
^{239}Pu	1.4 E-5	1.3 E-8	1.6 E-10
^{240}Pu	2.3 E-6	2.9 E-9	3.7 E-11
^{241}Pu	2.3 E-5	3.8 E-8	4.8 E-10
^{241}Am	2.3 E-5	3.8 E-8	4.8 E-10
^{243}Am	2.3 E-8	2.0 E-11	2.5 E-13
^{244}Cm	1.4 E-7	9.9 E-11	1.2 E-12

waste - sodium nitrate, nitrite, hydroxide, aluminate, carbonate, etc. However, as mentioned above, no credible upset conditions were identified that would result in a liquid release to the environment.

3.4.5 Determination of Facility Effluent Monitoring Plan Requirements

Attachment 1 lists the inventory at risk for radioactive materials. Information on specific radionuclides, physical/chemical forms, quantities on hand, quantities released with (and without) emission controls, and projected doses (without controls) is given.

No routine or credible upset conditions exist that would result in a liquid release to the environment. The only identified gaseous effluent to the environment is through 296-C-05 Stack. Offsite doses resulting from the proposed upset conditions do not exceed the FEMP requirement criterion.

3.4.6 Summary

The only identified effluent stream to the environment is via the 296-C-05 Stack. No liquid effluent streams result from normal processes. No credible upset conditions exist that would result in the release of radioactive liquids to the environment. Based on the nonradioactive hazardous materials in use, their concentrations, and 40 CFR 302.4 (EPA 1987) RQs, no credible upset conditions exist that could result in the release of a RQ of material.

The two effluent release conditions of concern are the yearly routine airborne releases and an upset condition resulting in an airborne release. Calculations detailed above have shown that offsite doses resulting from these two conditions do not approach the 0.1 mrem criterion established by regulation as requiring a FEMP.

It is the conclusion of this report that the 224-CR Vault does not need a FEMP.

3.5 DOUBLE-CONTAINED RECEIVER TANKS

3.5.1 Introduction

This section provides information to determine if a FEMP is required for the DCRT and ancillary systems.

3.5.2 Potential Effluent Streams

3.5.2.1 Double-Contained Receiver Tanks Ventilation System. The ventilation systems for the 244-A and 244-S DCRT are identical. The ventilation systems for the 244-BX, 244-TX, and 244-U facilities are similar to that of 244-S.

At 244-A and 244-S, the receiver tank, the pump and filter pits, and the tank vault annulus are vented via one ventilation exhaust system. Outside air is supplied to the vault annulus at 100 ft^3/min after passing through an electrical heater, a roughing filter, and a single-stage HEPA filter. A centrifugal-type, 1-horsepower, electrically powered fan (165 ft^3/min capacity) exhausts air from the facility at about 125 ft^3/min via an electrical heater and one of two parallel systems containing a roughing filter, and two stages of HEPA filtration. Exhaust air is sampled and monitored for radioactive particulate content before discharge to the atmosphere via the 6-in. dia., 16-gauge galvanized steel, 11-ft-tall stack. The supply air electrical heater is rated at 6,800 Btu/h; the exhaust air heater at 8,530 Btu/h.

All the equipment in the exhaust air ventilation system up to the fan is installed in the filter pit. The fan and the stack are located outside the filter pit near the instrument enclosure. Filters are installed in jumpers with PUREX-type remote connectors, making remote maintenance and replacement possible.

At 244-BX, 244-TX, and 244-U, the volume of supply air is 125 ft^3/min and exhaust is provided by single 250-ft^3/min fans. Three filter jumpers, each containing a roughing filter and two stages of HEPA filters, with a capacity of 125 ft^3/min, are installed in the filter pit. Two of the filter jumpers are normally on line; backup capability is provided by the installed spare.

An instrument enclosure, adjacent to the filter pit (244-A, 244-BX, 244-S, 244-TX, 244-U) shelters transmitters and other locally mounted process and ventilation control instruments. These enclosures are prefabricated metal buildings, 8 by 12 by 9 ft high. They are ventilated by power roof ventilators (300 ft^3/min, 1/15 hp), which are equipped with birdscreens and backdraft dampers.

Safety considerations and controls for the ventilation systems require dampers and valves for regulation/isolation, measurement of differential pressure across the filters, continuous radioactive particulate monitoring and record sampling of exhaust air, and continuous flow measurement of exhaust air.

At 244-S and 244-A, high differential pressures (4 in. wg) across the roughing filter and the first of two HEPA filters in each tank sound an alarm in 242-S/242-A Building control rooms to note that action is required. Low differential pressures across the final HEPA filter in each filter bank automatically shut down the exhaust fan and sound an alarm. The exhaust stacks are equipped with continuous flow recorders and continuous air samplers. High activities detected by the air samplers and/or loss of sampler functions will shut down the exhaust fan and sound an alarm. Shutdown of an exhauster heater also sounds an alarm. All alarms for 244-S are located on Panel G in the control room of 242-S; (all alarms for 244-A are located in the control room of 242-A). Provisions have been made to allow in-place testing of filters by introducing known particulates into the vault annulus with the inlet air stream and measuring their removal efficiency.

The ventilation controls for 244-BX, 244-TX, and 244-U are the same as discusses previously for 244-S and 244-A. Alarms sound in occupied areas,

i.e., for 244-BX, alarm panels are located in 241-BY-254 Building and annunciate in 242-S Building; and for 244-U, alarms are located in 241-U Building and annunciate in 242-S Building.

3.5.2.2 Leak Detection. Each receiver vessel pit (pump pit, filter pit, instrument pit, and flush pit) contains leak detectors that annunciate in the DCRT instrument house and the associated control room. The pump pit leak detector is interlocked to shut down the transfer pump and all the jet pumps. The flush pit leak detector is interlocked to shut down the DCRT transfer pump. The filter pit and the instrument pit leak detectors activate alarms.

All the pits (filter pit, pump pit, instrument pit, and flush pit) drain to the receiver tanks. The drain lines are equipped with traps with liquid-level detectors (high and low) that indicate if a sufficient amount of water is in the trap to isolate the tank's atmosphere from the environment. The annulus has a sump and a sump pump to remove liquid if the primary vessel leaks.

The transfer lines out of the DCRTs have leak detectors on the encasement just outside and, if applicable, at the tie-in point between the new pipe-in-pipe-encased portion and the existing concrete-encased portion. A leak would drain back or to the DCRTs. Either one or both of the encasement leak detectors would activate (depending on the location of the leak) and shut down the transfer pump.

The annulus sump is equipped with a leak detector that is interlocked to shut down all the jet pumps transferring into the DCRTs in the event of a primary vessel leak. A primary vessel leak would also be detected by the annulus air sampling system, which is interlocked to shut down the jet pumps on detection of airborne contamination.

The raw-water flush line from the flush pit is tied in directly to the discharge jumper for the DCRT transfer pump. Consequently, process solution would get back to the flush pit if the block valve of the flush line leaked through. A pressure switch located on the flush line in the flush pit detects this situation and is interlocked to shut down the transfer pump.

3.5.3 Determination of Facility Effluent Monitoring Plan Requirements

The routine radioactive airborne effluents from the DCRTs have been evaluated. The stack releases from these facilities for CY 1989 are listed in Table 3-8. The normal releases are through a prefilter and two HEPA filters in a series, which have efficiencies of 35%, 99.97%, and 99.90%, respectively. If an assumed decontamination factor of 3,000 is used, the annual releases for both gross alpha and gross beta without the filters is also shown.

Assuming the worst-case conditions that all alpha disintegrations are from ^{239}Pu and all the beta from ^{90}Sr, the annual releases without filtration or during upset conditions are estimated to be below the 0.1 mrem/yr evaluation criterion by a factor of 10^2. Based on this, it is recommended that FEMPs need not be prepared for the DCRTs for radioactive airborne effluent releases.

Table 3-8. Double-Contained Reciever Tank Annual Airborne Releases, Curies.

Facility	Stack	With filtration		Without filtration	
		Alpha	Beta	Alpha	Beta
244-A	296-A-25	<8.5 E-09	<2.9 E-08	<2.5 E-05	8.7 E-05
244-S	296-S-22	<8.5 E-09	<2.9 E-08	<2.5 E-05	5.7 E-05
244-TX	296-T-18	<1.2 E-08	<4.2 E-08	<3.6 E-05	1.3 E-05
244-BX	296-B-28	<1.4 E-08	<4.6 E-08	<4.2 E-05	1.4 E-05

No processing or decontamination work is currently performed in the DCRTs, so no hazardous airborne effluents are generated in either the normal or upset modes.

An evaluation of the DCRT facilities shows that liquids will not be released from them. Even though large quantities of potentially toxic, corrosive, persistent, and carcinogenic extremely hazardous waste are pumped to or through these facilities, two or more independent failures would be required to release the wastes to the environment. All waste solutions are contained in the piping or receiver tank (primary containment), which is physically inside the DCRT structures (secondary containment).

No chemical processing or decontamination other than flushing out tanks and pipes is conducted in these facilities. Therefore, no hazardous materials or radioactive waste is generated.

The 244-U DCRT has not been used at this time. The operating history and emissions from the other salt well receiver facilities should be comparable to that expected for the 244-U facility, should it become operational.

3.5.4 Summary

Based on the information presented here, the five DCRT systems discussed in this section do not require FEMPs.

4.0 POTENTIAL UPSET-OPERATING CONDITIONS

Section 3.0 of this document is a determination of whether Tank Farm facilities meet the criteria for requiring FEMPs. The Tank Farms covered in this evaluation are SST, DST, 204-AR and 244 CR Vaults, and the DCRT.

This section is prepared in accordance with the Guide (WHC 1991). Basic information for the FEMP Determination is presented. The evaluation was based on information obtained in documents, from interviews with cognizant engineers, and from personal observations.

A FEMP is required if the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a RQ as listed in 40 CFR 302 (EPA 1989c) or is designated a dangerous waste in WAC 173-303 (WAC 1989a) (e.g., a permitted quantity). In addition, the presence of any potentially contaminated liquid effluent requires a FEMP.

Data used in this evaluation to convert projected radionuclide releases to offsite doses were developed by the Pacific Northwest Laboratory (Appendix A). Airborne releases were assumed to occur from either an 89-m stack or at ground level from a central location in the 200 East or West Area. The distance from the 200 West release point to the offsite location is assumed to be 24,000 m. The distance from the 200 East release point to the offsite location is assumed to be 16,000 m.

Where possible, actual monitoring data were used to project the radiation dose to offsite individuals. When actual data were used, a protection factor of 3,000 was assumed for effluent systems that were normally filtered with high effeciency particulate air (HEPA) filters. This was to satisfy the EPA requirement that no engineered controls be considered in the FEMP determination. Where no actual monitoring data existed, the best available source term data were used. The DOE orders also require a FEMP evaluation to be performed under anticipated facility upset conditions.

Also where possible, individual radionuclides were used to calculate radiation doses. In some cases, only total alpha and total beta figures were available. In those cases, ^{239}Pu and ^{90}Sr were used to represent total alpha and beta, respectively.

4.1 DOUBLE-SHELL WASTE TANKS

4.1.1 Determination of Facility Effluent Monitoring Plan Requirements

Attachment 1, the Facility Effluent Monitoring Plan determination forms, list inventory at risk for radioactive and nonradioactive hazardous materials. Projected doses presented in the attachment were calculated with the use of AIRDOSE/RADRISK (CAP-88) (Beres 1990). Projected doses from Stack 296-A-40 (241-AP Tank Exhaust) indicates that the criteria for requiring a FEMP for this facility has been met or exceeded.

4.1.2 Potential Upset Conditions

No potential upset conditions have been identified or deemed credible. No mechanisms were identified for routine release of the DST-contained radionuclides offsite and, therefore, no analyses were performed for operational radiological impact to the offsite population. Ecological impacts from this facility are essentially unchanged from present conditions.

4.2 SINGLE-SHELL WASTE TANKS

4.2.1 Determination of Facility Effluent Monitoring Plan Requirements

4.2.1.1 Radioactive Contamination of Gaseous Effluents.

4.2.1.1.1 Passive Breather Systems. The most probable failure of SSTs equipped with passive breather systems, loss of the seal loop fluid, would cause the contaminated atmosphere in the SSTs to vent to the ambient environment. The consequences of this failure were evaluated. The assumptions were:

- The atmosphere is vented for 8 d (the seal loop fluid is checked weekly)
- The atmosphere is vented at the rate of 8 ft^3/min (conservative for the diameter piping used and the potential differential pressures)
- The radionuclide concentrations listed in Table 3-6.

The dose for the maximally exposed offsite member of the public was estimated at 2.0×10^{-7} rem whole body for a 1-yr commitment period. The exposure is less than the 0.1 mrem criteria for requiring a FEMP.

Using other more realistic assumptions, such as loss or bypass of the emission control devices and venting of the headspace gases by natural mechanisms (uncontrolled release), results in even lower exposures for the maximally exposed offsite individual. The HEPA filters are checked for particle capture efficiency at least every 6 mo (WHC 1988). Over such an extended period, a continuous flow of 8 ft^3/min appears unrealistic. The flow depends on barometric pressure and temperature differentials between the ambient and tank atmospheres. The flows would equilibrate slowly because of the small pressure differential that could be imposed and the pressure drops through the system (e.g., HEPA filter, small diameter piping connecting the HEPA filter, and tank atmosphere). Flow would be in opposite directions for almost equal periods. Therefore, it is assumed that the out-flow average would be 0.1 ft^3/min. The flow is 1/80 of that assumed in the scenario for 180 d versus 7 d or 25.7 times longer. The dose is estimated to be $1/80 \times 25.7 = 0.032$ of that estimated, or 6.4×10^{-8} rem to the maximally exposed individual. For the situation where the gaseous emissions are

released without controls, the emissions and the resultant dose from the loss of HEPA filter evaluated above is doubled. Under these conditions, the dose to the maximally exposed member of the public is projected to be 1.3×10^{-4} mrem.

4.2.1.1.2 **Active Ventilation Systems.** The SSTs in Tank Farms A, C, and SX have active ventilation systems as described in Sections 2.2.2.1.1, and 2.2.2.1.2. The consequences of the loss of filtration with the exhaust blower operating was described in subsection 9.3.1.3 of Prosk and Smith (1986). The scenario is for an accident condition and postulates the loss of both HEPA filters for 4 h. An abnormal operation is the loss of a single barrier with a probability of greater than 1×10^{-2} y, the probability assigned to this event by the authors. The release of radionuclides would be four times the values shown in the table for an active system. Two maximum offsite doses were evaluated, a person on Highway 240 (4.5 km from the release point) and a person residing 12.5 km from the release point. The 1-yr whole body dose commitment estimated for these maximally exposed offsite individuals were 0.76 mrem and 0.73 mrem respectively. Back calculation of the active ventilation volumetric flow rate assumed for the scenario indicates a value of approximately 4,850 ft^3/min. Although this value exceeds the flow rate for the A and C systems and is less than the SX system, the differences do not result in any significant change in the dose calculated for the event. The 0.1 mrem criteria is exceeded, indicating that SSTs with active ventilation systems require a FEMP.

4.2.1.2 **Emission of Hazardous Waste in Gaseous Emissions.**

4.2.1.2.1 **Passive Breathers.** In SSTs with passive breathers, the nonvolatile hazardous materials and radioactive materials present in the waste are intermingled. Based upon the total activities released and the concentrations of radionuclides in the waste (Jungfleisch 1984), the total mass of waste released is gram quantities. Thus, the quantities of wastes released are well below any reportable quantities for the nonvolatile hazardous waste.

The release of volatile components (organic vapors and ammonia) from tanks 241-C-102 and -103 has been previously covered and are below RQs or permitted concentrations.

4.2.1.2.2 **Active Ventilation.** As described above, the quantities of hazardous materials that could be released are well below RQs for the hazardous materials involved.

4.2.1.3 **Release of Radioactive Contaminants in Liquid Effluents.**

4.2.1.3.1 **Passive Breathers.** By the common definition for an effluent (materials routinely emitted by a process or system via some well-defined path), SSTs equipped with passive breathers do not have liquid effluents. At a minimum, all piping except that associated with removing residual liquid has been disconnected. Active ventilation is required for the wastes with high

heat generation that could generate moisture. Without active ventilation to carry moisture into the ventilation ducts, condensate cannot form. Condensate is not anticipated for SSTs equipped with passive breathers.

Some SSTs with and without active ventilation systems have lost containment and leaked. Approximately 45% (66 of 149) of all SSTs are currently listed as "assumed leakers." The leaking SSTs are spread throughout all tank farms and are independent of age or design (roughly 50% of the most recently constructed SSTs (A and AX Tank Farms) are designated as assumed leakers.

Leakers release large volumes of liquids. Table G-1 of Hanlon (1990) estimates the volumes of liquids is from 115,000 gal (241-T-106, 1973) to less than reportable values (241-T-108, -T-111, -TY-101, -T-103, -T-109). These estimates do not include cooling water sprayed on the surface of 241-A-105 (5,000 gal, 1963) that may have been drained to the soil under the tank. Although not evaluated, the quantities of radionuclides and hazardous materials released probably exceed the FEMP criteria.

Although the failure frequency for the SSTs fits the criteria for an abnormal event, 1×10^{-2}/yr, a leaker represents the complete loss of containment and would not be considered an upset condition. Furthermore, the path of the liquid released cannot be defined before the fact because the location of the leak cannot be predicted. Monitoring and control of such releases have not been addressed (BAT). Other techniques currently employed are used to detect and evaluate the liquid volume released. Therefore, for the purposes of these analyses, SST leaks are not considered liquid effluents.

4.2.1.3.2 Active Ventilation Systems. All SSTs with active ventilation systems have process condensates. The moisture released from the liquid in the waste at elevated temperatures condenses on the cool surfaces of the ventilation ducts and drains back into the SST. Any surface contamination on the ducts is anticipated to be picked up by the process condensates. Therefore, any process condensate that is lost from the ducts potentially carries radionuclides to the soil; the system would require a FEMP.

Furthermore, the condensate from the steam coils in the SX system could carry radionuclides to the crib if the coils lose integrity. This condition also would categorize the SX system as requiring a FEMP.

4.2.1.4 Release of Hazardous Materials in Liquid Effluents.

4.2.1.4.1 Passive Breathers. For the purposes of these analyses, SSTs equipped with passive breathers do not generate liquid effluent.

4.2.1.4.2 Active Ventilation Systems. The anticipated quantity of waste carried to the ventilation system is small. The radionuclides and hazardous wastes are intermingled and if the release level was significant, the radiation level in the ventilation systems would be detected. Therefore, the amount of hazardous wastes that could be carried by the liquid effluents is assumed to be small and would not exceed RQs.

4.3 204-AR WASTE UNLOADING FACILITY DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENTS

Attachment 1 lists the inventory at risk for radioactive materials at the 204-AR Waste Facility. Information on specific radionuclides, physical and chemical forms, quantities released (with and without emission controls), and projected doses (without controls) is given.

Liquid effluents are not considered to be contaminated with hazardous materials. All other liquid wastes generated by operation of the facility are routed to underground waste storage tanks for subsequent processing in 242-A.

The only identified gaseous radioactive effluent to the environment is through the 296-A Stack. Calculations performed (Attachment 1) show no routine or credible upset conditions that could result in the release of an amount of material that would produce offsite doses that exceed the FEMP requirement criterion.

4.4 244-CR VAULT

4.4.1 Potential Gaseous Radioactive Source Terms

The only routine gaseous effluents anticipated are associated with the three active ventilation systems. The measured emissions for CY 1989 (Brown 1990) are the following:

	Gross Alpha, Ci	Gross Beta, Ci
296-C-5 Stack	<8.98 E-08	<1.90 E-06

However, although the ventilation system has been active, the vault has only been used to transfer waste once or twice in the last several years. Therefore, these measured emissions are probably not representative of routine emissions during facility operation.

From the CY 1989 effluent discharge report, the gross alpha is taken to be ^{239}Pu and the gross beta as ^{90}Sr. Title 40 CFR 61, Subpart H (EPA 1987) specifies that the estimated release quantities shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facilities' operation was otherwise normal. To adjust the annual discharge numbers for the lack of filtration, a multiplication factor of 3,000 has been chosen. To compensate for the fact that the facility was not operational during 1989, the readings will be adjusted by another factor of 10. As a result, the annual discharge with no filtration will be 2.69×10^{-03} Ci of ^{239}Pu and 6.0×10^{-02} Ci of ^{90}Sr. With these assumptions, the dose to the maximally exposed offsite individual is projected to be:

CAP-88	0.02 mrem
GENII	0.02 mrem.

These values are less than the 0.1 mrem criterion that would require a FEMP.

Another possible situation that could result in the release of radioactive hazardous material to the atmosphere is a process upset consisting of a leak in the exposed piping or tank. This could result in a pool of liquid waste in the bottom of a vault cell. The following discussion describes the consequences of a worst-case piping leak upset. This scenario establishes an upper-level boundary for this type of upset condition.

The source term for this upset condition would be produced by venting the contaminated atmosphere of the vault. Venting the contaminated atmosphere in a SST to the ambient environment has been evaluated. The radionuclide concentrations assumed for the SST venting are listed in Table 3-7.

The active ventilation in a SST is assumed to produce a flow of about 4,850 ft^3/min and the 244-CR ventilation produces a flow of about 4,200 ft^3/min. However, the SST ventilation is taken from the enclosed air space above the contained liquid. The vault ventilation path could expect concentrations for active ventilation that are greater than those listed above by a factor of 10. A review of the above list shows that the nuclides of consequence are ^{90}Sr, ^{137}Cs, and ^{239}Pu. For this evaluation, it is assumed that it would take approximately 10 h for a leak to be discovered and for the liquid to be pumped from the cell sump back into a tank. It is further assumed that the HEPA filtration is 99.9% efficient, providing a reduction factor of 1,000. The resulting release for this upset condition would be 4.6×10^{-05} Ci ^{90}Sr, 2.3×10^{-06} Ci ^{137}Cs, and 1.4×10^{-08} Ci ^{239}Pu. This results in a dose to the maximally exposed offsite member of the general public of the following:

CAP-88	2.2 E-06 mrem (Beres 1990)
GENII	1.7 E-06 mrem (EPA 1989b).

This exposure is less than the 0.1 mrem criterion for requiring a FEMP.

4.4.2 Potential Nonradioactive Gaseous Source Terms

Under the alkaline conditions in the SSTs, almost all the ammonium/ammonia present in the waste is found in the form of dissolved ammonia gas. Small but unquantified amounts of ammonia have been emitted from the waste in some DSTs and have led to the formation of ammonium nitrate via a gas-phase reaction. The highest ammonia concentrations, 7.8 mol%, are postulated for the DSTs used to store PUREX neutralized cladding waste. Based on the RQs listed in 40 CFR 302.4 (EPA 1987) for the hazardous materials present in the waste (lowest value 100 lb for ammonia and sodium nitrite) and the extremely small amounts that could be present in gaseous effluents during routine operations or during an upset condition, release of a RQs in one year is not credible.

4.4.3 Potential Radioactive Liquid Source Terms

As mentioned above, the process condensate, if formed, occurs in the air exhaust duct. The duct has some radioactive surface contaminants that are carried with the liquid. As mentioned earlier, the installation of a stack catch tank will eliminate this effluent path.

Any liquid losses caused by piping or tank leaks within the facility would be retained within the vault system; these losses would be returned to the tanks via the cell sumps. No credible upset conditions were identified that would result in a liquid release to the environment.

4.4.4 Potential Nonradioacitve Liquid Source Terms

If a reasonable potential existed for the creation of any liquid effluents, the liquids would most likely be contaminated with the principle chemical compounds found in SST waste - sodium nitrate, nitrite, hydroxide, aluminate, carbonate, etc. However, as mentioned above, no credible upset conditions were identified that would result in a liquid release to the environment.

4.4.5 Determination of Facility Effluent Monitoring Plan Requirements

Attachment 1 lists the inventory at risk for radioactive materials. Information on specific radionuclides, physical/chemical forms, quantities on hand, quantities released with (and without) emission controls, and projected doses (without controls) is given.

No routine or credible upset conditions exist that would result in a liquid release to the environment. The only identified gaseous effluent to the environment is through 296-C-05 Stack. Offsite doses resulting from the proposed upset conditions do not exceed the FEMP requirement criterion.

4.5 DOUBLE-CONTAINED RECEIVER TANKS DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENTS

The routine radioactive airborne effluents from the DCRTs have been evaluated. The stack releases from these facilities for CY 1989 are listed in Table 3-8. The normal releases are through a prefilter and two HEPA filters in a series, which have efficiencies of 35%, 99.97%, and 99.90%, respectively. If an assumed decontamination factor of 3,000 is used, the annual releases for both gross alpha and gross beta without the filters is also shown.

Assuming the worst-case conditions that all alpha disintegrations are from ^{239}Pu and all the beta from ^{90}Sr, the annual releases without filtration or during upset conditions are estimated to be below the 0.1 mrem/yr evaluation criterion by a factor of 10^2. Based on this, it is recommended that FEMPs need not be prepared for the DCRTs for radioactive airborne effluent releases.

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5.0 SUMMARY

5.1 DOUBLE-SHELL TANKS

Based on the information gathered here, some DSTs (i.e., those served by the 241-AY and -AZ Tank exhaust, the 241-W Tank exhaust, the 241-AP Tank exhaust and the 241-SY Tank exhaust) will require FEMPs because either their potential emissions, or inventories at risk, or both are greater than the criteria.

5.2 SINGLE-SHELL TANKS

Based on the information gathered here, the 11 SSTs served by the 3 active ventilation systems (A, C, and SX) will require FEMPs because of their potential emissions of radionuclides in their gaseous and liquid effluents. Attachment 1 provides specific information on inventories at risk used to determine the requirement for FEMPs.

5.3 204-AR WASTE UNLOADING FACILITY

The only identified effluent stream to the environment is via the 296-A-26 Stack. No liquid effluent streams result from normal processes. No credible upset conditions exist that would result in the release of radioactive liquids to the environment. Based on the nonradioactive hazardous materials in use, their storage locations, concentrations, and 40 CFR 302.4 (EPA 1989b) RQs, no credible upset conditions exist that could result in the release of a RQs of material.

The two conditions of concern are the yearly routine airborne releases and an upset condition resulting in an airborne release. Calculations detailed above have showed that offsite doses resulting from these two conditions do not approach the 0.1 mrem EDE limit established by regulation as requiring a FEMP.

The conclusion of this report is that the 204-AR Waste Unloading Facility does not need a FEMP.

5.4 244-CR VAULT

The only identified effluent stream to the environment is via the 296-C-05 Stack. No liquid effluent streams result from normal processes. No credible upset conditions exist that would result in the release of radioactive liquids to the environment. Based on the nonradioactive hazardous materials in use, their concentrations, and 40 CFR 302.4 (EPA 1987) RQs, no credible upset conditions exist that could result in the release of a RQ of material.

The two effluent release conditions of concern are the yearly routine airborne releases and an upset condition resulting in an airborne release. Calculations detailed above have shown that offsite doses resulting from these two conditions do not approach the 0.1 mrem criterion established by regulation as requiring a FEMP.

It is the conclusion of this report that the 224-CR Vault does not need a FEMP.

5.5 DOUBLE-CONTAINED RECEIVER TANKS

Based on the information presented here, the five DCRT systems discussed in this section do not require FEMPs.

6.0 REFERENCES

Atomic Energy Act of 1954, as amended, 42 USC 2011.

Beres, D. A., 1990, *The Clean Air Act Assessment Package - 1988 (CAP-88), A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air*, Volumes 1-3, U.S. Environmental Protection Agency, Washington, D.C.

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EPA, 1989c, "Designation, Reportable Quantities, and Notification," Title 40, Code of Federal Regulations, Part 302, U.S. Environmental Protection Agency, Washington, D.C.

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Resource Conservation and Recovery Act of 1976, as amended, 42 USC 6901 et seq.

Schmidt, J. W., C. R. Huckfeldt, A. R. Johnson, S. M. McKinney, 1990, *Westinghouse Hanford Company Environmental Surveillance Annual Report--200/600 Areas*, WHC-EP-0145-2, Westinghouse Hanford Company, Richland, Washington.

Tranbarger, R. K., 1991, *Activated-Carbon Filtration of Organic and Ammonia Vapors from Underground Single-Shell Tanks*, WHC-SA-1080-S, Westinghouse Hanford Company, Richland, Washington.

WAC, 1989a, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Olympia, Washington.

WHC, 1991, *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans*, WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington.

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT FORMS

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AY and -AZ Tank DISCHARGE POINT 296-A-17 Stack Exhaust

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. $^{89,90}Sr$	Particulate	3.9 E-06	1.2 E-02	5.1 E-04
2. ^{137}Cs	Particulate	3.2 E-05	9.6 E-02	2.3 E-03
3. ^{106}Ru	Particulate	1.1 E-05	3.3 E-02	6.9 E-04
4. ^{113}Sn	Particulate	2.0 E-06	6.0 E-03	7.1 E-06
5. ^{125}Sb	Particulate	6.0 E-06	1.8 E-02	7.5 E-05
6. ^{129}I	Particulate	8.2 E-04	2.0 E-02	3.02 E-03
TOTAL				1.0 E-02

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report For Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M Cummins DATE 11/8/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER Jack Ciucci DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AW Tank Exhaust **DISCHARGE POINT** 296-A-27 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1.	$^{89,90}Sr$	Particulate	3.3 E-08	9.9 E-05	4.3 E-06
2.	^{137}Cs	Particulate	7.2 E-08	2.2 E-04	5.2 E-06
3.	^{106}Ru	Particulate	6.4 E-04	1.9 E-00	4.0 E-02
4.	^{113}Sn	Particulate	6.9 E-06	2.1 E-02	2.4 E-05
5.	^{125}Sb	Particulate	1.4 E-05	4.2 E-02	1.7 E-04
6.	^{129}I	Particulate	1.7 E-04	3.4 E-03	6.26 E-04
TOTAL					4.0 E-02

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb/day)	Reportable quantity (lb/day)	% of reportable quantity/ day
1. Ammonia	Not Avail.	27.9	100	27.9%

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report For Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352. DSI from G. M. Crummel to D. Wiggins (April 13, 1990)

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M. Crummel DATE 11/8/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER _____ DATE 11-8-91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AN Tank Exhaust DISCHARGE POINT 296-A-29 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. $^{89,90}Sr$	Particulate	2.3 E-08	6.9 E-05	3.0 E-06
2. ^{137}Cs	Particulate	3.9 E-07	1.2 E-03	2.8 E-05
TOTAL				3.1 E-05

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR _____ DATE 11/8/91

MANAGER, ENVIRONMENTAL _____ DATE 11-8-91

FACILITY MANAGER _____ DATE 11/5/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AP Tank Exhaust DISCHARGE POINT 296-A-40 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. $^{89,90}Sr$	Particulate	2.6 E-08	7.8 E-05	3.4 E-06
2. ^{137}Cs	Particulate	5.1 E-08	1.5 E-04	3.7 E-06
3. ^{106}Ru	Particulate	9.2 E-03	2.8 E-01	5.8 E-01
4. ^{113}Sn	Particulate	2.9 E-04	8.7 E-01	1.0 E-03
5. ^{125}Sb	Particulate	1.2 E-04	3.6 E-01	1.5 E-03
6. ^{129}I	Particulate	3.8 E-04	1.1 E-00	1.1E-04
TOTAL				0.58

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb/day)	Reportable quantity (lb/day)	% of reportable quantity/day
1. Ammonia	Not Avail.	13.2	100	13.2%

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352. 40 CFR 302.4
DSI from G. M. Crummel to D. Wiggins (April 13, 1990)

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required _____

EVALUATOR Gary M Crummel DATE 11/13/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER [signature] DATE 11-8-91

**Based on EDE >0.1 mrem for single discharge point.

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 101-AY Tank Annulus Exhaust DISCHARGE POINT 296-A-18 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	4.5 E-08	1.4 E-04	1.2 E-03
2. Gross beta	Particulate	1.5 E-07	4.5 E-04	2.0 E-05
TOTAL				1.2 E-03

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M Cummings DATE 11/8/91

MANAGER, ENVIRONMENTAL RKP K P Dietlein DATE 11-8-91

FACILITY MANAGER Joe A Ruic DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 102-AY Tank Annulus Exhaust DISCHARGE POINT 296-A-19 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	2.2 E-08	6.6 E-05	5.7 E-04
2. Gross beta	Particulate	7.4 E-08	2.2 E-04	9.7 E-06
TOTAL				5.8 E-04

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR _____ DATE 11/8/91

MANAGER, ENVIRONMENTAL _____ DATE 11-8-91

FACILITY MANAGER _____ DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AZ Tank Annuli Exhaust DISCHARGE POINT 296-A-20 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	5.5 E-08	1.7 E-04	1.4 E-03
2. Gross beta	Particulate	1.9 E-07	5.7 E-04	2.5 E-05
TOTAL				1.4 E-03

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR [signature] DATE 11/3/91

MANAGER, ENVIRONMENTAL [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AW Tank Farm Annuli Exhaust DISCHARGE POINT 296-A-28 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	1.5 E-07	4.5 E-04	3.9 E-03
2. Gross beta	Particulate	6.9 E-06	2.1 E-02	9.1 E-04
TOTAL				4.8 E-03

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR [signature] DATE 11/8/91

MANAGER, ENVIRONMENTAL RAP [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AW Tank Annuli Exhaust DISCHARGE POINT 296-A-30 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	3.3 E-07	9.9 E-04	8.6 E-03
2. Gross beta	Particulate	1.2 E-06	3.6 E-03	1.6 E-04
TOTAL				8.8 E-03

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M Cummins DATE 11/8/91

MANAGER, ENVIRONMENTAL RXR A P Smith DATE 11-8-91

FACILITY MANAGER Joel G Lee DATE 11/5/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-AP Tank Farms Annuli Exhaust DISCHARGE POINT 296-A-41 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	4.3 E-07	1.3 E-03	1.1 E-02
2. Gross beta	Particulate	1.5 E-06	4.5 E-03	2.0 E-04
TOTAL				1.1 E-02

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M Cummings DATE 11/8/91

MANAGER, ENVIRONMENTAL CRP W D Winkler DATE 11-8-91

FACILITY MANAGER Joel A Lee DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-SY Tank Farm Annuli Exhaust DISCHARGE POINT 296-P-22 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	2.3 E-08	6.9 E-05	3.6 E-04
2. Gross beta	Particulate	8.1 E-08	2.4 E-04	6.3 E-06
TOTAL				3.7 E-04

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
None				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M. Cummings DATE 11/8/91

MANAGER, ENVIRONMENTAL RAP [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-SY Tank Farm Ventilation DISCHARGE POINT 296-P-23 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	4.0 E-08	1.2 E-04	6.2 E-04
2. Gross beta	Particulate	6.5 E-07	2.0 E-03	5.1 E-05
TOTAL				6.7 E-04

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb/day)	Reportable quantity (lb/day)	% of reportable quantity/day
1. Ammonia	Not Avail.	2.5	100	2.5%
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352. 40 CFR 302.4
DSI from G. M. Crummel to D. Wiggins (April 13, 1990)

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M Crummel DATE 11/31/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER _____ DATE 11-8-91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY SST on passive breather 200E Area (Tank Farms A, AX, B, BX, BY, C) DISCHARGE POINT Individual Tanks

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. ^{90}Sr	Solid Particle, SrO	3.2 E-06	6.4 E-03*	2.80 E-04
2. ^{137}Cs	Solid Particle, Cs_2O	1.2 E-06	2.3 E-03*	5.50 E-05
3. ^{238}Pu	Solid Particle, PuO_2	7.0 E-11	1.4 E-07*	1.12 E-06
4. ^{239}Pu	Solid Particle, PuO_2	1.2 E-09	2.5 E-06*	2.17 E-05
5. ^{240}Am	Solid Particle, AmO_2	3.7 E-09	7.3 E-06*	9.56 E-05
TOTAL				5.00 E-04

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. *				
TOTAL				

Identification of Reference Material

*see text

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required ____ FEMP is not required X

EVALUATOR [signature] DATE 11/3/91

MANAGER, ENVIRONMENTAL [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/6/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY SST on passive filters 200W Area (Tank Farms S, T, TX, TY, U) DISCHARGE POINT Individual Tanks

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. ^{90}Sr	Solid Particle, SrO	3.2 E-06	6.4 E-03*	1.66 E-04
2. ^{137}Cs	Solid Particle, Cs_2O	1.2 E-06	2.3 E-03*	3.27 E-05
3. ^{238}Pu	Solid Particle, PuO_2	7.0 E-11	1.4 E-07*	6.66 E-07
4. ^{239}Pu	Solid Particle, PuO_2	1.2 E-09	2.5 E-06*	1.29 E-05
5. ^{241}Am	Solid Particle, AmO_2	3.7 E-09	7.3 E-06*	5.69 E-05
TOTAL				~3.00 E-04

*see text

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. *				
TOTAL				

Identification of Reference Material

*see text

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Guy M Cummins DATE 11/8/91

MANAGER, ENVIRONMENTAL RP [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/8/91

9411136.1250

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY SX Tank Farm DISCHARGE POINT 296-S-15

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. ^{137}Cs	Solid Particle, Cs_2O	2.3 E-09	9.3 E-03*	1.32 E-04
2. ^{90}Sr	Solid Particle, SrO	4.5 E-08	1.8 E-01*	4.68 E-03
3. ^{239}Pu	Solid Particle, PuO_2	1.4 E-11	5.6 E-05*	2.88 E-04
4. ^{238}Pu	Solid Particle, PuO_2	2.3 E-13	9.2 E-07*	4.38 E-06
5. ^{241}Am	Solid Particle, AmO_2	2.3 E-11	9.2 E-05*	7.17 E-04
TOTAL				0.005

FEMP required due to potential release of liquid effluent contaminated with radionuclides to soil.

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. *				
TOTAL				

Identification of Reference Material

*see text

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Guy M Cummins DATE 11/3/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER J. C. Sain DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-C-104/-105/-106 DISCHARGE POINT 296-P-16

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. ^{137}Cs	Solid Particle, Cs_2O	2.3 E-09	9.3 E-03*	2.22 E-04
2. ^{90}Sr	Solid Particle, SrO	4.5 E-08	1.8 E-01*	7.88 E-03
3. ^{239}Pu	Solid Particle, PuO_2	1.4 E-11	5.6 E-05*	4.86 E-04
4. ^{238}Pu	Solid Particle, PuO_2	2.3 E-13	9.2 E-07*	7.38 E-06
5. ^{241}Am	Solid Particle, AmO_2	2.3 E-11	9.2 E-05*	1.21 E-03
TOTAL				0.01

FEMP required due to potential release of liquid effluent contaminated with radionuclides to soil.

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. *				
TOTAL				

Identification of Reference Material

*see text

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required _____

EVALUATOR Gary M Cummins DATE 11/3/91

MANAGER, ENVIRONMENTAL RKP [signature] DATE 11-5-91

FACILITY MANAGER [signature] DATE 11/5/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 241-A-105 DISCHARGE POINT 296-P-17

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. ^{137}Cs	Solid Particle, Cs_2O	2.3 E-09	9.3 E-03*	2.22 E-04
2. ^{90}Sr	Solid Particle, SrO	4.5 E-08	1.8 E-01*	7.88 E-03
3. ^{239}Pu	Solid Particle, PuO_2	1.4 E-11	5.6 E-05*	4.86 E-04
4. ^{238}Pu	Solid Particle, PuO_2	2.3 E-13	9.2 E-07*	7.38 E-06
5. ^{241}Am	Solid Particle, AmO_2	2.3 E-11	9.2 E-05*	1.21 E-03
TOTAL				0.01

FEMP required due to potential release of liquid effluent contaminated with radionuclides to soil.

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. *				
TOTAL				

Identification of Reference Material

*see text

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required _____

EVALUATOR [signature] DATE 11/3/91

MANAGER, ENVIRONMENTAL ORP [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/5/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 204-AR Vault DISCHARGE POINT 296-A-26 Stack (Routine Yearly Release)

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity Released w/Controls (Ci)	Quantity released w/o Controls (Ci)	Projected dose w/o Controls (mrem)
1. ^{90}Sr	Particulate	9.27 E-04	9.27 E-04	4.06 E-05 (3.15 E-05 GENII)
2. ^{239}Pu	Particulate	2.71 E-04	2.71 E-04	2.35 E-03 (1.73 E-03 GENII)
TOTAL		11.98 E-04	11.98 E-04	2.39 E-03 (1.76 E-03 GENII)

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. N/A				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas, (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352.
204-AR Waste Handling Facility Safety Analysis Report, 1981

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR _____ DATE 11/3/91

MANAGER, ENVIRONMENTAL _____ DATE 11-8-91

FACILITY MANAGER _____ DATE 11/9/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 204-AR Vault DISCHARGE POINT 296-A-26 Stack
Upset Condition

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity Released w/Controls (Ci)	Quantity released w/o Controls (Ci)	Projected dose w/o Controls (mrem)
1. ^{90}Sr	Particulate	0.120	6 E-05	4.34 E-07 (3.20 E-07 GENII)
2. ^{239}Pu	Particulate	10^{-4}	5 E-08	2.63 E-06 (2.04 E-06 GENII)
TOTAL		0.12	6 E-05	3.06 E-06 (2.36 E-06 GENII)

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. N/A				
TOTAL				

Identification of Reference Material

204-AR Waste Handling Facility Safety Analysis Report, 1981

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR [signature] DATE 11/5/91

MANAGER, ENVIRONMENTAL [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/5/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 244-CR Vault DISCHARGE POINT 296-C-5 Stack (Upset Condition)

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity Released w/Controls (Ci)	Quantity released w/o Controls (Ci)	Projected dose w/o Controls (mrem)
1. ^{90}Sr	Particulate	4.6 E-02	4.6 E-05	2.01 E-06 (1.56 E-06 GENII)
2. ^{239}Pu	Particulate	1.4 E-05	1.4 E-08	1.21 E-07 (8.96 E-08 GENII)
3. ^{137}Cs	Particulate	3.3 E-03	2.3 E-06	5.5 E-08 (5.06 E-08 GENII)
TOTAL		4.8 E-02	4.8 E-05	2.2 E-06 (1.7 E-06 GENII)

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. N/A				

Identification of Reference Material

Prosk and Smith, January 1986, *Single-Shell Tank Isolation Safety Analysis Report*, SD-WM-SAR-006, Rev. 1, Rockwell Hanford Operations, Richland, Washington 99352. Higley and Kurath, 1984, *Hanford Defense Waste Environmental Impact Statement Engineering Data Package: Existing Tank* SD-WM-DP-005, Rockwell Hanford Operations, Richland, Washington 99352

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Guy M Cummins DATE 11/5/91

MANAGER, ENVIRONMENTAL RP [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 244-CR Vault DISCHARGE POINT 296-C-5 Stack
Normal Operations

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity Released w/Controls (Ci)	Quantity released w/o Controls (Ci)	Projected dose w/o Controls (mrem)
1. ^{90}Sr	Particulate	6.0 E-02	6.0 E-02	2.63 E-03 (2.04 E-03 GENII)
2. ^{239}Pu	Particulate	2.69 E-03	2.69 E-03	0.02 (1.72 E-02 GENII)
TOTAL		6.3 E-03	6.3 E-03	0.02 (0.02 GENII)

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. N/A				
TOTAL				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas. (WHC-EP-0141-2) Westinghouse Hanford Company, Richland, Washington 99352. 40 CFR 61

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M Cummins DATE 11/8/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER Joel A Lee DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 244-A Lift Station Catch Tank DISCHARGE POINT 296-A-25 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide*	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	8.5 E-09	2.5 E-05	2.2 E-04
2. Gross beta	Particulate	5.8 E-05	8.74 E-05	3.8 E-06
TOTAL				2.2 E-04

*Alpha assumed to be ^{239}Pu and beta ^{90}Sr

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Brown, M. J., R. K. P'Pool, and S. P. Thomas, May 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, Westinghouse Hanford Company, Richland, Washington 99352

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required. _____ FEMP is not required X

EVALUATOR Guy M Cummel DATE 11/8/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER Jack Cline DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 244-BX DISCHARGE POINT 296-B-28 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide*	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	<1.35 E-08	4.1 E-05	3.5 E-04
2. Gross beta	Particulate	<4.6 E-08	1.4 E-04	6.1 E-06
TOTAL				3.6 E-04

*Alpha assumed to be ^{239}Pu and beta ^{90}Sr

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Brown, M. J., R. K. P'Pool, and S. P. Thomas, May 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, Westinghouse Hanford Company, Richland, Washington 99352

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR [signature] DATE 11/8/91

MANAGER, ENVIRONMENTAL [signature] DATE 11-8-91

FACILITY MANAGER [signature] DATE 11/5/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 244-S DISCHARGE POINT 296-S-22 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide*	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	<8.46 E-09	2.5 E-05	1.3 E-04
2. Gross beta	Particulate	<2.9 E-08	8.7 E-05	2.2 E-06
TOTAL				2.2 E-04

*Alpha assumed to be ^{239}Pu and beta ^{90}Sr

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Brown, M. J., R. K. P'Pool, and S. P. Thomas, May 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, Westinghouse Hanford Company, Richland, Washington 99352

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Guy McCormack DATE 11/8/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER Joel Cline DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 244-TX DISCHARGE POINT 296-T-18 Stack

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide*	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. Gross alpha	Particulate	<1.23 E-08	3.7 E-05	1.9 E-04
2. Gross beta	Particulate	<4.22 E-08	1.3 E-04	3.3 E-06
TOTAL				1.9 E-04

*Alpha assumed to be ^{239}Pu and beta ^{90}Sr

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

Brown, M. J., R. K. P'Pool, and S. P. Thomas, May 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, Westinghouse Hanford Company, Richland, Washington 99352

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M. Cammann DATE 11/8/91

MANAGER, ENVIRONMENTAL RR L. P. Diediker DATE 11-8-91

FACILITY MANAGER Joel Alan DATE 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY 244-U DISCHARGE POINT No Operations Yet

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (Ci)	Projected dose w/o controls (mrem)
1. No emissions history because facility has not been operated				

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released (lb)	Reportable quantity (lb)	% of reportable quantity/yr
1. None				
TOTAL				

Identification of Reference Material

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR Gary M Cummins DATE 11/8/91

MANAGER, ENVIRONMENTAL RKP DATE 11-8-91

FACILITY MANAGER Joel A Lane DATE 11/8/91

Science Applications International Corporation
An Employee-Owned Company

91-0007.WNH
January 7, 1991

Mr. Joel Eacker
Tank Farm Management
Westinghouse Hanford Company
P. O. Box 1970, MSIN R1-51
Richland, WA 99352

REFERENCE: PURCHASE ORDER CONTRACT MLW-SVV-518974

SUBJECT: FINAL FEMP DETERMINATION FORM FOR TASK ORDER 91-05

Dear Joel:

In accordance with the deliverable requirements of Task Order 91-05 of Purchase Order MLW-SVV-518974, I am providing the Final FEMP Determination Form for Tank Farms, including ancillary systems. The purpose of the FEMP Determination Form is to recommend whether or not a FEMP is required based on information collected and the results of calculations performed. SAIC staff who supported this effort included Jofu Mishima, Judson Kenoyer, Greg Martin, Ken Ridgway, and Bill Herrington.

SAIC appreciated the opportunity to provide this work to you. If there are any questions concerning our work, please do not hesitate to contact Bill Herrington on 943-3133 or by facsimile on 943-5121.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

William Herrington

William N. Herrington
Senior Radiological Engineer

Mell Roy, Esq.
Program Manager

Enclosure

1845 Terminal Drive, Suite 130, Richland, Washington 99352 • (509) 943-3133
Other SAIC Offices: Albuquerque, Boston, Colorado Springs, Dayton, Huntsville, Las Vegas, Los Angeles, McLean, Oak Ridge, Orlando, Palo Alto, Seattle, Tucson

Science Applications International Corporation
An Employee-Owned Company

91-0034.JLK
January 31, 1991

Mr. Joel Eacker
Tank Farm Management
Westinghouse Hanford Company
P. O. Box 1970, MSIN R1-51
Richland, WA 99352

REFERENCE: PURCHASE ORDER CONTRACT MLW-SVV-518974

SUBJECT: FEMP DETERMINATION REPORT FOR TASK ORDER 91-05

Dear Joel:

In accordance with the deliverable requirements of Task Order 91-05 of Purchase Order MLW-SVV-518974, I am providing the FEMP Determination Report for Tank Farms, including ancillary systems. The purpose of the FEMP Determination Report is to complete the documentation on the recommendations as to whether or not a FEMP is required based on information collected and the results of calculations performed. SAIC staff who supported this effort included Jofu Mishima, Judson Kenoyer, Greg Martin, Ken Ridgway, Mickey Beary, and Bill Herrington.

SAIC appreciated the opportunity to provide this work to you. If there are any questions concerning our work, please do not hesitate to contact Bill Herrington on 943-3133 or by facsimile on 943-5121.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Judson L. Kenoyer
Senior Health Physicist

Enclosure

1845 Terminal Drive, Suite 130, Richland, Washington 99352 • (509) 943-3133
Other SAIC Offices: Albuquerque, Boston, Colorado Springs, Dayton, Huntsville, Las Vegas, Los Angeles, McLean, Oak Ridge, Orlando, Palo Alto, Seattle, Tucson

PART 15

242-A EVAPORATOR

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

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CONTENTS

LIST OF TABLES

TERMS

AMU	aqueous make-up
ASF	ammonia scrubber feed
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR	Code of Federal Regulations
CRW	cladding removal waste
DDSSF	dilute double-shell slurry feed
DSSF	double-shell slurry feed
DST	double-shell tank
DW	dangerous waste
EDE	effective dose equivalent
EDTA	ethylenediamine tetraacetic acid
EHW	extremely hazardous waste
EPA	U.S. Environmental Protection Agency
ETF	Effluent Treatment Facility
FEMP	facility effluent monitoring plan
HEDTA	hydroxy ethylenodiaminetriacetic acid
HEPA	high-efficiency particulate air
HVAC	heating, ventilation, and air conditioning
LERF	Liquid Effluent Retention Facility
MOV	motor-operated valve
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
PUREX	Plutonium-Uranium Extraction
REDOX	Reduction/Oxidation
RQ	reportable quantity
SC	steam condensate
SST	single-shell tank
TRU	transuranic
UBC	Uniform Building Code
WAC	Washington Administrative Code

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1.0 INTRODUCTION

This document is a determination of whether the 242A Evaporator Facility requires a facility effluent monitoring plan (FEMP). This document contains a brief facility description, the source term or inventory of radioactive and nonradioactive materials at the facility, and a determination of the effective offsite dose as calculated from conversion factors generated by the U.S. Environmental Protection Agency (EPA)-approved CAP-88 (Beres 1990) computer program.

A FEMP is required if the total projected dose from radionuclides exceeds 0.1 mrem effective dose equivalent (EDE) from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity (RQ) as listed in 40 Code of Federal Regulations (CFR) 302.4 (EPA 1989a) or is designated a Dangerous Waste in Washington Administrative Code (WAC) 173-303-70 through WAC 173-303-103 (WAC 1989a) (e.g., a permitted quantity).

Data used in this evaluation to convert projected radionuclide releases to offsite doses were developed by the Pacific Northwest Laboratory (PNL). Airborne releases were assumed to occur from ground level from a central location in the 200 East Area. The distance from the 200 East release point to the offsite location is assumed to be 16,000 m.

Actual monitoring data were used to project the radiation dose to offsite individuals. A protection factor of 3,000 was assumed for effluent systems that were normally filtered with high-efficiency particulate air (HEPA) filters. This satisfies the EPA requirement that no engineered controls be considered in the FEMP determination.

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2.0 FACILITY DESCRIPTION

2.1 PHYSICAL DESCRIPTION

The 242-A Evaporator complex is located in the 200 East Area of the Hanford Site, which is located in south central Washington State. The 242-A Building is located south of the 241-A and 241-AX Tank Farms and north of the 242-AW Tank Farm. The complex covers approximately 15,000 ft^2.

The 242-A Building contains the evaporator vessel and supporting process equipment. The building ventilation exhaust fans and HEPA filter housings are located on the north side of the building. An emergency diesel generator is located on the south side of the building. Raw water, steam, and electrical power are provided to the 242-A building from existing service facilities in the 200 East Area.

In general, the 242-A E/C facility can be divided into three areas: process, service, and operating. The process area includes the evaporator room, pump room, condenser room, and ion exchange enclosure. The service area includes the aqueous make-up (AMU) room; loadout and hot equipment storage room; loading room; and heating, ventilation, and air conditioning (HVAC) room. The operating areas include the control room, men's and women's change rooms, lunchroom, office, and storage rooms.

The principal process components of the evaporator/crystallizer system are located in the process building (242-A) and the control room building (242-AB), with supporting service and operating areas. The 242-A Evaporator is a multistory, structural steel, reinforced-concrete building and includes two adjoining but structurally independent structures, herein designated A and B. Building 242-AB is adjoined to, but structurally independent of, Building 242-A. An additional building, 242-A-81, is located adjacent to the employee parking lot directly south of Building 242-A.

Building 242-A has plan dimensions of approximately 75 ft by 108 ft and is 62 ft above finished grade at its highest point. A portion of the building extends 10 ft below grade.

Structure A, which houses processing and service areas, (e.g., evaporator room, HVAC room, etc.) is a reinforced-concrete shear wall and slab structure with concrete mat footing in below-grade regions and spread footing elsewhere. It has plan dimensions of 50 ft by 75 ft.

Structure B of Building 242-A is separated from structure A by a seismic joint. It houses operating and personnel support areas. The roof consists of metal decking supported by structural steel members spanning to reinforced concrete block walls. The foundations for Structure B are continuous strip footings. This structure measures 11 ft high with approximate plan dimensions of 42 ft by 47 ft. It was constructed in accordance with Uniform Building Code (UBC) requirements.

Building 242-AB houses the control room for the evaporator. The roof consists of metal decking supported by structural steel members spanning to reinforced concrete block walls. This structure is 40 ft by 43 ft, with a height close to that of Structure B. Building 242-AB was constructed in accordance with UBC requirements.

Building 242-A-81 is the water services building for the 242-A E/C facility. This building houses the pumps, valves, and filters for supplying raw process water to the 242-A Evaporator. Building 242-A-81 is an insulated preengineered metal building placed on a concrete slab. The building is approximately 20 ft by 28 ft and has a nominal height of 10 ft.

There are six 70,000-gal cement retention basins located east of the evaporator building. These are designated as the 207-A Retention Basins. Each basin is approximately 40 ft wide by 90 ft long and 5 ft deep. The north three basins are used for holding steam condensate from the 242-A Evaporator before discharge to the B Pond system. Each of these three basins, as part of the current 242-A facility upgrade, will be fitted with a high-density polyethylene protective liner that will serve as an additional leak barrier. This barrier design was based on the composition of the steam condensate waste stream and the rate at which the basin could be emptied. The other three basins were used to hold process condensate from the 242-A E/C. These three basins will not be used in the future and are scheduled for closure. The purpose of the retention basins is to retain the condensate while sample analyses are being performed. Although the condensate is sampled in the condenser room before discharge to the basins, a basin sample is taken and laboratory analysis of the sample is performed to verify compliance with environmental regulations.

An enclosed pump pit, the 207-A Building, contains the pumps, piping, and diversion control valving required for handling the steam condensate stream. The steam condensate (SC) gravity flows from 242-A to the 207-A Building. The SC can be routed to any one of the three SC retention basins by opening the appropriate motor-operated valve (MOV). The pumps can move SC in the basins to either the B Pond system or back to the 242-A Evaporator feed tank (241-AW-102) via the A-350 Catch Tank. The building is constructed of reinforced concrete.

A more detailed facility description is available in SD-WM-SAR-023, *242-A Evaporator/Crystallizer Safety Analysis Report* (WHC 1988).

2.2 PROCESS DESCRIPTION

The 242-A Evaporator is the primary waste concentrator for Hanford Site wastes that are stored in underground, double-shell tanks (DST). Low-heat-generating liquid wastes (<0.1 Btu/h/gal) that contain relatively small amounts of fission products are stored in the underground tanks. The 242-A Evaporator uses evaporative concentration followed by crystallization and precipitation of salts to reduce the volume of wastes, thus reducing the

number of tanks required for storage. The facility receives a mixed waste stream containing radionuclides in excess of release limits and organic and inorganic constituents. It separates the waste into two streams as follows:

- One waste stream (concentrated slurry stream) containing essentially all of the radionuclides and inorganic constituents (an extremely hazardous waste)
- One waste stream (process condensate) containing volatile organic materials and greatly reduced de minimus concentrations of radionuclides (a dangerous waste containing de minimus quantities of radionuclides).

The 242-A Evaporator receives a mixed blend feed from DST 242-AW-102. The feed consists of unprocessed and processed waste as well as recycled liquid that is removed from storage tanks after solids have settled. The feed is pumped into the recirculation line on the upstream side of the reboiler at a rate controlled to maintain a constant liquid level in the vapor-liquid separator. As the feed enters the recirculation line, it blends with the main process slurry stream, which flows to the reboiler.

In the reboiler, the mixture is heated slightly to a specific operating temperature, normally 100 to 170 °F, by using 3- to 10-psig steam. The low-pressure steam provides adequate heat input, and the resulting low temperature differential across the reboiler helps minimize scale formation on the heat transfer surfaces.

The heated slurry stream is discharged from the reboiler to the vapor-liquid separator, which is maintained at a pressure of 35 to 85 torr (0.68 to 1.64 psia). Under this reduced pressure, a fraction of the water in the heated slurry flashes to steam and is drawn through 2 wire-mesh deentrainer pads into a 42-in. vapor line that leads to the primary condenser. As evaporation takes place in the separator vessel, the slurry becomes supersaturated. This supersaturation promotes the growth of existing crystals and forms some new salt crystals in the slurry liquor. After the process slurry has remained in the vapor-liquid separator for approximately 2 min, the slurry flows to the recirculation pump (P-B-1) suction via the bottom of the separator vessel and the lower recirculation line. The recirculation pump discharges the slurry back to the reboiler through the upper recirculation line, thus completing the process. The process is continuous with typical stream flowrates of 90 to 140 gal/min from the feed tank, 20 to 60 gal/min for the condensate, and 43 to 90 gal/min for the slurry discharge.

The recirculation pump moves waste at high velocities through the reboiler to accomplish the following:

- Improve the heat transfer coefficient
- Reduce fouling of heat transfer surfaces
- Keep solids in suspension
- Permit transfer of large quantities of heat with only a small change to the temperature of the solution being heated.

The static pressure of the solution above the reboiler is sufficient to suppress the boiling point so the solution will not boil in the reboiler tubes. Boiling occurs only near or at the liquid surface in the vapor-liquid separator.

When the process solution has been concentrated to a specified parameter, a small fraction is withdrawn from the upper recirculation line upstream of the feed addition point and is pumped by the slurry pump (P-B-2) to underground storage tanks. In the storage tanks the solids settle, allowing the slurry to separate into solid and liquid layers. The liquid layer is removed and may be set aside or returned to the feed tank and mixed with other evaporator waste feed stocks.

Because of the high concentration of solids in the slurry, settling solids may plug the transfer lines from the evaporator to the tank farm settling tanks. The slurry pump is designed for high pressures so the slurry can be transferred at high velocities to alleviate this problem.

Pressure in the vapor-liquid separator is maintained at approximately 35 to 85 torr (0.68 to 1.64 psia) via the primary condenser and process vapor line by a two-stage steam-jet eductor system. Steam from the primary jet and the secondary jet discharges to the intercondenser and after-condenser, respectively. Both condensers drain to the process condensate collection tank (TK-C-100), while noncondensables are filtered and discharged to the atmosphere via the vessel vent system.

3.0 STATUS OF OPERATION

The 242-A Evaporator did not operate during 1989 and is currently in a standby mode.

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4.0 SOURCE TERM

This section provides information on identifying and characterizing all potential process source terms present in the facility.

4.1 IDENTIFICATION OF WASTE TYPES AT THE 242-A EVAPORATOR

The source terms are the types and quantities of mixed waste brought into the facility and the process chemicals that are stored in the facility. Waste to be treated at the facility is received from DSTs via the evaporator feed tank (DST 102-AW). The waste stored in the DSTs is classified as a mixed waste, because it contains both radioactive and dangerous chemical components. The waste is a dangerous waste (DW) because of corrosivity and toxicity characteristics and nonspecific source listed wastes, and is an extremely hazardous waste (EHW) because of toxicity (state criteria only), carcinogenicity, and persistence under the state mixture rule.

The 242-A Evaporator facility receives this mixed waste stream containing organic and inorganic constituents and radionuclides in excess of release limits and separates the waste into two streams as follows:

- One waste stream containing essentially all of the radionuclides and inorganic constituents (an extremely hazardous mixed waste)
- One waste stream containing water and greatly reduced concentrations of radionuclides and the volatile organic materials (a dangerous waste containing minimal quantities of radionuclides).

These two streams exit the 242-A Evaporator treatment process. One stream (the slurry) contains most of the radionuclides and inorganics. It is recycled back to the DST system for further treatment. The other stream (the process condensate) contains the volatile organics and water. It is pumped to the Liquid Effluent Retention Facility (LERF) where it is stored to await further treatment by the Effluent Treatment Facility (ETF). Under normal operating circumstances, neither of these streams is considered as an effluent to the environment.

Wastes are processed through the 242-A Evaporator in different batches according to their classification by total organic content, transuranic (TRU) content, and effects on the evaporation process. Dilute complex wastes are received from the processing operations of B Plant, while a mixture of noncomplexed wastes is received from a number of operations, including the Plutonium-Uranium Extraction (PUREX) Plant, single-shell tank (SST), salt well pumping, and N Reactor.

Waste stored in the DST facilities and treated by the 242-A Evaporator includes the following:

- Complexed Waste: The complexed wastes that are processed were generated during B Plant processing. This waste contains high amounts of total organics, such as the complexants ethylenediamine

tetraacetic acid (EDTA) and hydroxy ethylenediaminetriacetic acid (HEDTA). These wastes must be processed separately in the 242-A Facility because of their adverse effects on evaporation and their TRU content.

- Dilute Noncomplexed Waste: This waste is the composite of a number of wastes. These wastes may be mixed during collection and storage before treatment. They include:

  - The PUREX nonaging waste or low-level waste including neutralized decladding waste supernate and ammonia scrubber feed (ASF)

  - Plutonium Finishing Plant (PFP) low-level processing waste supernate

  - B Plant process and miscellaneous waste including cell drainage and vessel cleanout waste

  - S Plant laboratory and decontamination waste

  - T Plant spent decontamination solutions

  - 300 Area laboratory and fuels fabrication waste

  - 400 Area equipment decontamination waste

  - 100-N dilute phosphate decontamination waste and 100 Area spent fuel storage basin sulfate waste from ion exchange regeneration and sand filter backwashing (no longer generated)

  - The SST salt well pumping waste

  - Laboratory wastes and decontamination solutions generated at the Reduction/Oxidation (REDOX) Complex

  - Dilute double-shell slurry feed (DDSSF)

  - Double-shell slurry feed (DSSF).

Feed concentrations and chemical composition will vary from run to run depending on the waste source, the degree to which the waste has previously been concentrated in the evaporator, and blending with other feeds. The largest portion of these wastes is aqueous salts. The four primary feeds into the evaporator are consolidations of the waste sources listed previously. These are: the cladding removal waste (CRW) feed, ammonia scrubber feed (ASF), Salt well feed, and linked run feeds.

Radionuclide and nonradionuclide potential source terms within the facility are located within the evaporator/separator and reboiler process loop.

4.2 EVAPORATOR SEPARATOR POTENTIAL SOURCE TERMS

The separator has a normal operating capacity of from 22,500- to 25,00-gal (including recirculation loop and reboiler). Total volume when filled to the top of the vapor section is 35,600 gal. Table 4-1 contains radionuclide composition data for the separator. These values were obtained by comparing those values listed in the *Hazard Classification* WHC-SD-WM-PSE-008 (WHC 1990) to those values listed in *Methods and Data for Use in Determining Source Terms for the Grout Disposal Program* WHC-SD-WM-TI-355 (WHC 1990a). Table 4-1 was then generated by taking the maximum value from the two referenced sources. The first two numerical columns in Table 4-1 are those values. The third column is the quantity of the particular radionuclide that could be present at any one time in the separator at its maximum capacity of 35,600 gal. Radionuclides are also reportable under the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA). The asterisk in the last column denotes that these radionuclides could become reportable under CERCLA.

Table 4-2 lists the nonradionuclide constituents that could be present in the Evaporator Separator. These values were obtained by comparing the values contained in WHC-SD-WM-SAR-023, *242-A Evaporator Safety Analysis Report* (WHC 1988); WHC-SD-WM-PSE-008, *Hazard Classification* (WHC 1991a), and DOE/RL-90-42, Rev. 0, *Evaporator Dangerous Waste Permit Application.* Table 4-2 was then generated by taking the maximum value from the referenced sources. Table 4-2 converts that value to the quantity of the constituent that could exist in the separator at its maximum capacity of 134,746 L. The final column in this table lists the CERCLA-reportable quantity (RQ) for each chemical as found in 40 CFR 302.4 (EPA 1989a). If the value in this column is released to the environment during a 24-h period, it then becomes reportable under CERCLA. An asterisk in the "Maximum Quantity" column denotes that this particular constituent could possibly become reportable.

4.3 PROCESS CONDENSATE POTENTIAL SOURCE TERMS

Table 4-3 lists nonradionuclide constituents in the process condensate. The data in each of the columns have been compiled from the following references:

WHC-EP-0342, Addendum 15, *242-A Evaporator Process Condensate Stream-Specific Report* (WHC 1990b)

DOE/RL-90-42, *242-A Evaporator Dangerous Waste Permit Application* (DOE/RL 1990)

Table 4-3 lists the maximum concentrations of the constituents and compares these values to the CERCLA-RQ value. The columns in Table 4-3 are defined as follows:

The "Maximum Concentration" column is the maximum concentration of the constituent found in any reference source

Table 4-1. Normal Evaporator Feed Stream Source Terms. (2 Sheets)

Radionuclide	Maximum determined sample concentrations		
	(Ci/gal)	(μCi/mL)	(Ci)
^{241}Am	1.02 E-5	0.0027	0.3631
^{243}Am	7.7 E-06	0.0020	0.2741
^{3}H	7.2 E-5	0.019	2.56
^{14}C	9.8 E-04	0.2589	34.89
^{244}Cm	4.9 E-05	0.0129	1.74
^{60}Co	1.4 E-4	0.038	4.98
^{134}Cs	2.1 E-2	5.6	747.60
^{135}Cs	2.5 E-05	0.0066	0.89*
^{137}Cs	4.9 E-00	1,294.6	174,440.0*
^{129}I	9.8 E-06	0.0026	0.3489*
^{63}Ni	9.8 E-03	2.589	348.88
^{94}Nb	1.6 E-4	0.042	5.696
^{237}Np	1.5 E-05	0.0040	0.534*
^{79}Se	1.6 E-4	0.043	5.696
^{238}Pu	3.8 E-6	0.001	0.135
^{239}Pu	3.8 E-04	0.1004	13.53
^{240}Pu	4.9 E-06	0.0013	0.174
^{241}Pu	1.3 E-04	0.0343	4.63
^{226}Ra	4.9 E-15	1.29 E-12	1.7 E-10
^{106}Ru	2.0 E-01	52.84	7,120.0
^{151}Sm	1.0 E-01	26.42	3,560.0
^{126}Sn	7.7 E-05	0.0203	2.74
^{90}Sr	7.0 E-01	184.94	24,920.0
^{99}Tc	7.7 E-03	2.0343	274.1*
^{230}Th	2.5 E-13	6.6 E-11	8.90 E-9
^{233}U	1.1 E-10	2.9 E-8	3.92 E-6
^{234}U	2.0 E-7	5.3 E-5	0.0071
^{235}U	4.9 E-07	0.0001	0.0174*
^{238}U	9.8 E-06	0.0026	0.3489*

Table 4-1. Normal Evaporator Feed Stream Source Terms. (2 Sheets)

Radionuclide	Maximum determined sample concentrations		
	(Ci/gal)	(μCi/mL)	(Ci)
^{93}Zr	4.9 E-05	0.0129	1.744
^{124}Sb	5.3 E-03	1.4	188.68
^{125}Sb	1.5 E-02	3.96	534.0
^{144}Ce	3.2 E-03	0.845	113.9

Table 4-2. Evaporator Separator Nonradionuclide Source Term. (6 Sheets)

Chemical	Constituent maximum concentration (ppb)	Constituent maximum concentration (g/l)	Constituent maximum quantity (kg)	CERCLA reportable quantity (kg)
Aluminum	2.14 E+7	21.4	2,883.6	no RQ
Ammonium Hydroxide	6.77 E+5	0.677	91.22	454
Aluminum Oxide (AlO_2-)	5.8 E+7	58	7,815.3	no RQ
Ammonium	5.36 E+6	5.36	722.2	no RQ
Barium	82,400	0.0824	11.1	454
Boron	1.04 E+5	0.104	14.0	no RQ
Calcium	1.46 E+6	1.46	196.7	no RQ
Cadmium	16,000	0.0160	2.16	4.54
Carbonate (CO_3)	2.95 E+7	29.5	3,975.0	no RQ
Chloride (Cl-)	9.6 E+6	9.6	1,293.6	no RQ
Chromium	8.5 E+5	0.85	114.5	2,270
Copper	4.71 E+6	4.71	634.7	2,270
Cyanide (CN-)	98,000	0.098	13.2*	4.54
Fluoride (F-)	3.67 E+7	36.7	4945.2	no RQ
Hydroxide (OH-)	9.9 E+7	99.0	13,339.9	no RQ
Iron	70,000	0.07	9.4	no RQ
Lead	72,000	0.072	9.7*	0.454
Magnesium	29,000	0.029	3.9	no RQ

Table 4-2. Evaporator Separator Nonradionuclide Source Term. (6 Sheets)

Chemical	Constituent maximum concentration (ppb)	Constituent maximum concentration (g/l)	Constituent maximum quantity (kg)	CERCLA reportable quantity (kg)
Manganese	29,000	0.029	3.9	no RQ
Mercury	16,000	0.016	2.2*	0.454
Molybdenum	88,000	0.088	11.9	no RQ
Nickel	53,000	0.053	7.1*	0.454
Nitrate (NO_3-)	2.9 E+8	290	39,076	no RQ
Nitrite (NO_2-)	8.4 E+7	84	11,318.7	no RQ
Phosphate (PO_4)	2.96 E+7	29.7	3,988.5	no RQ
Phosphorus	4.9 E+6	4.9	660.3*	0.454
Potassium	4.04 E+7	40.4	5,443.7	no RQ
Silicon	2.71 E+9	2,710	365,161.7	no RQ
Sodium	3.4 E+8	340	45,813.6*	4.54
Sodium Aluminate	2.049 E+8	204.9	27,609.46	no RQ
Sodium Carbonate	2.438 E+8	243.8	32,851.07	no RQ
Sodium Chloride	7.5 E+5	0.705	95.0	no RQ
Sodium Fluoride	1.26 E+8	126.0	16,978.0*	454
Sodium Hydroxide	2.6 E+8	260.0	35,033.96*	454
Sodium Nitrate	3.57 E+8	357.0	48,104.32	no RQ

Table 4-2. Evaporator Separator Nonradionuclide Source Term. (6 Sheets)

Chemical	Constituent maximum concentration (ppb)	Constituent maximum concentration (g/l)	Constituent maximum quantity (kg)	CERCLA reportable quantity (kg)
Sodium Nitrite	3.384 E+8	338.4	45,598.05*	45.4
Sodium Phosphate	8.2 E+7	82.0	11,049.17*	2,270
Sodium Sulfate	4.2 E+7	42.6	5,740.18	no RQ
Sulfate (SO_4)	7.94 E+6	7.94	1,069.9	no RQ
Tungsten	2.1 E+5	0.21	28.3	no RQ
Uranium	1.2 E+5	0.12	16.2	45.4
Zinc	1.68 E+5	0.168	22.6	454
Acetone	2,100[1]	0.0021	0.28	2,270
Alkyl, hydroxymethyl benzene	1,800	0.0018	0.24	no RQ
Butanedioic Acid	4.2 E+5	0.42	56.6	no RQ
C3-Alkylbenzene	3.2 E+5	0.32	43.1	no RQ
Chloroethyl, 2-hydroxymethyl, BA	13,000	0.013	1.8	no RQ
2-Chloromethyl-hydroxy-methylbenzene	12,000	0.012	1.6	no RQ
2-Chloromethyl-o-xylene	6,600	0.0066	0.89	no RQ

Table 4-2. Evaporator Separator Nonradionuclide Source Term. (6 Sheets)

Chemical	Constituent maximum concentration (ppb)	Constituent maximum concentration (g/l)	Constituent maximum quantity (kg)	CERCLA reportable quantity (kg)
Citric Acid	53,000	0.053	7.14	no RQ
Diethyl-phthalates	6,600	0.0066	0.89	454
Dimethyl-toluidine	12,000	0.012	1.6	no RQ
Dioctyl-phthalate	24,000	0.024	3.23	no RQ
Dodecane	4,000	0.004	0.54	no RQ
Dodecanoic Acid	950	0.00095	0.13	no RQ
Ethanedioic Acid	4.2 E+6	4.2	565.93	no RQ
Ethyl, 2-methyl-hydroxy-methyl-benzenes	64,000	0.064	8.6	no RQ
Ethylbenz-aldahyde	6.9 E+5	0.69	92.97	no RQ
ED3A	18,000	0.018	2.4	no RQ
EDTA	85,000	0.085	11.5	2,270
Ethylxylene	320	0.00032	0.043	no RQ
Heptadecanoic Acid	2,400	0.0024	0.32	no RQ
Heptanedioic Acid	27,000	0.027	3.6	no RQ

Table 4-2. Evaporator Separator Nonradionuclide Source Term. (6 Sheets)

Chemical	Constituent maximum concentration (ppb)	Constituent maximum concentration (g/l)	Constituent maximum quantity (kg)	CERCLA reportable quantity (kg)
Hexadecanoic Acid	830	0.00083	0.11	no RQ
Hexanedioic Acid	64,000	0.064	8.6	no RQ
Hexanoic Acid	43,000	0.043	5.8	no RQ
Hydroxyacetic Acid	46,000	0.046	6.2	no RQ
2-Hydroxymethyl benzoic Acid	27,000	0.027	3.6	no RQ
Methylbenz-aldahyde	6.9 E+5	0.69	92.97	no RQ
2-Methylbenzoic Acid	18,000	0.018	2.4	no RQ
2- Methyl, hydroxy-methyl benzene	3.5 E+5	0.35	47.2	no RQ
Methyl-toluidine	3,500	0.0035	0.47	no RQ
n-C22H46 - C40H82	20,000	0.02	2.7	no RQ
HEDTA	20,000	0.02	2.7	no RQ
MAIDA	5.8 E+5	0.58	78.2	no RQ
MICEDA	30,000	0.03	4.04	no RQ
Nitrilotri-acetic Acid	7,500	0.0075	1.01	2,270

Table 4-2. Evaporator Separator Nonradionuclide Source Term. (6 Sheets)

Chemical	Constituent maximum concentration (ppb)	Constituent maximum concentration (g/l)	Constituent maximum quantity (kg)	CERCLA reportable quantity (kg)
Octodecanoic Acid	410	0.00041	0.055	no RQ
Pentadecane	3,700	0.0037	0.5	no RQ
Pentadecanoic Acid	35,000	0.035	4.7	no RQ
Pentanedioic Acid	70,000	0.07	9.4	no RQ
Propylbenze	1,800	0.0018	0.24	no RQ
Tetradecane	9,000	0.009	1.2	no RQ
Tetra-hydrofuran	27	2.7 E-5	0.0036	454
Tributyl Phosphate	27,000	0.027	3.6	no RQ
Tri-n-butyl (di-ol)-phosphate	11,000	0.011	1.5	no RQ
Tridecane	15,000	0.015	2.02	no RQ
1,3,5 Trimethyl benzene	78,000	0.078	10.5	no RQ
Undecane	3,300	0.0033	0.44	no RQ
Unknown phthalates	21,000	0.021	2.8	no RQ

Table 4-3. Process Condensate Nonradionuclide Source Term. (4 Sheets)

Chemical	Maximum concentration (ppb)	Maximum C-100 quantity (kg)	CERCLA reportable quantity (kg)	Maximum quantity per day (kg)
Aluminum	4,992	0.336	no RQ	1.633
Ammonium	9.35 E+6	629.9	no RQ	3,057.7
Ammonia	2.19 E+6	147.55*	45.4	716.2*
Arsenic (EP Toxic)	50	0.0034	0.454	0.0164
Barium (EP Toxic)	232	0.0156	454	0.0759
Barium	8	0.0005	454	0.0026
Boron	151	0.0102	no RQ	0.0494
Cadmium	10	0.0007	4.54	0.0033
Calcium	8,320	0.5605	no RQ	2.7208
Carbonate	7.5 E+5	50.53	no RQ	245.268
Chloride	2,300	0.1550	no RQ	0.7522
Chromium	156	0.0105	2,270	0.0510
Copper	127	0.0086	2,270	0.0415
Fluoride (IC)	2,100	0.1415	no RQ	0.6868
Fluoride (IS E)	65	0.0044	no RQ	0.0213
Fluoride	12,273	0.8269	no RQ	4.0136
Iron	503	0.0339	no RQ	0.1645
Lead	50	0.0034	0.454	0.0164
Magnesium	4,030	0.2715	no RQ	1.3179
Manganese	5	0.0003	no RQ	0.0016
Mercury (EP Toxic)	10	0.0007	0.454	0.0033
Mercury	0.7	4.7 E-5	0.454	0.0002
Nickel	17	0.0011	0.454	0.0056
Nitrate	5,000	0.3369	no RQ	1.6351
Phosphorus	6,195	0.4174	0.454	2.0259*
Potassium	19,238	1.2961	no RQ	6.2913

Table 4-3. Process Condensate Nonradionuclide Source Term. (4 Sheets)

Chemical	Maximum concentration (ppb)	Maximum C-100 quantity (kg)	CERCLA reportable quantity (kg)	Maximum quantity per day (kg)
Selenium (EP Toxic)	50	0.0034	45.4	0.0164
Silicon	985,819	66.4	no RQ	322.3865
Silver (EP Toxic)	50	0.0034	454	0.0164
Sodium	51,497	3.4695	4.54	16.8408*
Strontium	30	0.0020	no RQ	0.0098
Sulfate	13,000	0.8758	no RQ	4.2513
Sulfide	66,000	4.4466	no RQ	21.5836
Uranium	2.03	0.0001	45.4	0.0007
Vanadium	7	0.0005	no RQ	0.0023
Zinc	44	0.0030	454	0.0144
Acetone	5,100	0.3436	2,270	1.6678
Benzyl Alcohol	18	0.0012	no RQ	0.0059
Benzaldehyde	23	0.0015	no RQ	0.0075
2-Butoxy-Ethanol	920	0.0620	no RQ	0.3009
1-Butanol or Butyl Alcohol	1.21 E+5	8.1521	2,270	39.570
2-Butanone or Methylethyl Ketone	120	0.0081	2,270	0.0392
Butoxy-Glycol	810	0.0546	no RQ	0.2649
Butoxy-Diglycol	27	0.0018	no RQ	0.0088
Butoxytri-Ethylene-glycol	35	0.0024	no RQ	0.0114
Butraldehyde	230	0.0155	no RQ	0.0752

Table 4-3. Process Condensate Nonradionuclide Source Term. (4 Sheets)

Chemical	Maximum concentration (ppb)	Maximum C-100 quantity (kg)	CERCLA reportable quantity (kg)	Maximum quantity per day (kg)
Chloroform or 1,1,1-Tri-Chloromethane	27	0.0018	4.54	0.0088
Caproic Acid	70	0.0047	no RQ	0.0229
3,5-Dimethyl-Pyridine	24	0.0016	2,270	0.0078
Dimethyl-nitro-samine	57	0.0038	0.454	0.0186
Dodecane	46	0.0031	no RQ	0.0150
Etyoxytri-Ethylene Glycol	150	0.0101	no RQ	0.0491
Ethanol or Ethyl Alcohol	2	0.0001	0.454	0.0007
Hexanoic Acid	70	0.0047	no RQ	0.0229
Hexadecane	17	0.0011	no RQ	0.0056
2-Hexanone	79	0.0053	no RQ	0.0258
Heptadecane	18	0.0012	no RQ	0.0059
Methoxy-diglycol	52	0.0035	no RQ	0.0170
Methoxytri-Glycol	370	0.0249	no RQ	0.1210
M-Methoxyme-Thanamine	120	0.0081	no RQ	0.0392
Methlene Chloride	180	0.0121	454	0.0589
Methyl Nitrate	240	0.0162	no RQ	0.0785
Methyl N-Propyl Ketone	12	0.0008	no RQ	0.0039

Table 4-3. Process Condensate Nonradionuclide Source Term. (4 Sheets)

Chemical	Maximum concentration (ppb)	Maximum C-100 quantity (kg)	CERCLA reportable quantity (kg)	Maximum quantity per day (kg)
Methyl N-Butyl Ketone or 2-Pentanone	79	0.0053	no RQ	0.0258
Methyl Isobutyl Ketone (MIBK-Hexone)	68	0.0046	2,270	0.0222
2-Methyl-Nonane	17	0.0011	no RQ	0.0056
Methyl Vinyl Ketone	22	0.0015	no RQ	0.0072
N-Nitrosodi-methylamine	57	0.0038	4.54	0.0186
Nitro-Methane	8	0.0005	no RQ	0.0026
Pentadecane	20	0.0013	no RQ	0.0065
Phenol	33	0.0022	454	0.0108
2-Propenol	39	0.0026	0.454	0.0128
Pyridine	550	0.0371	454	0.1799
Tetradecane	440	0.0296	no RQ	0.1439
Tetrahydro-Furan	170	0.0115	454	0.0556
Tributyl-Phosphate	21,000	1.4148	no RQ	6.8675
1,1,1-Tri-Chlorethane	5	0.0003	454	0.0016
Tridecane	350	0.0236	no RQ	0.1145
Triglyme	90	0.0061	no RQ	0.0294
Undecane	950	0.0640	no RQ	0.3107

The "Maximum C-100 Quantity" column is the total possible quantity of the constituent present in the Process Condensate Collection Tank (C-100) calculated on the tank's maximum capacity of 17,800 gal

The CERCLA column is the RQ that, if releases in a 24-h period, is reportable under CERCLA

The asterisk denotes that the constituent is possibly reportable if released.

At a process condensate generation rate of 60 gal/min, it is possible to generate 86,400 gal/d. The "Maximum Quantity per Day" column has been included to identify any constituents that could become reportable under CERCLA if the process condensate were to be released to the environment over 24 h.

Table 4-4 contains data on process condensate radionuclide constituents from the following sources:

WHC-EP-0141, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987: 200/600 Areas* (Brown 1988)

WHC-EP-0141-1, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas* (Brown 1989)

WHC-EP-0141-2, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management for Calendar Year 1989: 200/600 Areas* (Brown 1990)

WHC-SD-WM-SAR-023, *242-A Evaporator Safety Analysis Report* (WHC 1988)

WHC-EP-0342, Addendum 15, *242-A Evaporator Process Condensate Stream-Specific Report* (WHC 1990b).

Table 4-4 compares those values given in the referenced sources and lists the maximum possible quantity (curies) in a full process condensate collection tank (C-100) with the maximum capacity of 17,800 gal. Also included is the total quantity of curies possible in a 24-h period, calculated on a 60 gal/min rate of process condensate generation. This process rate produces 86,400 gal/d.

Table 4-4. Process Condensate Radionuclide Source Term.

Effluent	Maximum		
	(μCi/mL)	C-100 (Ci)	24 H (Ci)
Alpha	9.5 E-7	0.0001	0.0003
Beta	7.4 E-5	0.0050	0.024
^{3}H	5.29	356.4	1729.96
^{241}Am	2.8 E-8	1.89 E-6	9.16 E-6
^{137}Cs	4.16 E-4	0.028	0.14
^{147}Pm	1.23 E-3	0.083	0.402
^{129}I	6 E-8	4.04 E-6	1.96 E-5
Uranium	1.89 E-5	0.0013	0.0062
$^{239,240}Pu$	1.5 E-8	1.01 E-6	4.91 E-6
^{106}Ru	9.92 E-3	0.67	3.24
^{113}Sn	5.1 E-4	0.034	0.167
$^{89,90}Sr$	4.91 E-4	0.033	0.161
^{155}Eu	1.32 E-3	0.089	0.432

4.4 242-A EVAPORATOR EFFLUENTS

4.4.1 242-A Evaporator Vessel Vent

Noncondensed vapors from the 242-A E/C are filtered and discharged to the atmosphere via the vessel vent system (296-A-22 stack). This system consists of a deentrainment unit, a prefilter, a heater, HEPA filters, a monitoring/sampling system, and a vessel vent exhauster.

Table 4-5 contains radionuclide emission data from the Evaporator Vessel Vent Stack 296-A-22. These data was obtained from the following sources:

WHC-SD-WM-SAR-023, *242-A Evaporator Safety Analysis Report* (WHC 1988)

WHC-EP-0141, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987: 200/600 Areas* (Brown 1988)

WHC-EP-0141-1, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas* (Brown 1989)

WHC-EP-0141.2, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas* (Brown 1990).

Table 4-5 compares the values contained in the referenced sources to obtain the maximum possible value. The table then uses this value to calculate the offsite dose that could result. Because specific radionuclide emission data were not always available from the references for all years, a direct determination of the maximum curie release for 1 yr was not, by simple comparison, judicious. Likewise, comparing 1988 and 1989 values was not prudent because the evaporator did not operate for the entire year of 1989. As a result, the derivation in the maximum radionuclide amount (curies) released for a year presented in Table 4-6 was determined in the following way:

First, the maximum annual volumetric flow was utilized from all the years listed in (total volume = $1.03 \times 10^{+10}$ L)

Second, the maximum specific radionuclide concentration that was discharged was used

Finally, these two values were multiplied, giving the maximum possible total release, in curies, that could result using the data available.

The "ANNUAL RELEASE With Controls" column represents these calculations. The "ANNUAL RELEASE Without Controls" column gives the values that could result if the HEPA filters were not in place. This value is 3,000 times the previous columns' values. The multiplication factor of 3,000 is based on a 99.97% HEPA filter efficiency and is an accepted factor to determine a worst-case release scenario. The CAP-88 (Beres 1990) conversion factor is from an approved EPA computer modeling program. These values will be repeated for convenience in Attachment 1-1.

Gases from the process condensate collection tank (C-100 Tank) are vented and released through the vessel vent system.

The highest permitted temperature in the process condensate collection tank is 145 °F. An alarm is set to activate at this temperature. Using this fact together with figures supplied by Westinghouse Environmental and Geotechnical Services, Inc., Table 4-6 was developed.

Ammonia samples (Drager tube) were taken from the vessel vent system between the dates of January 1, 1989 and March 24, 1989. Ammonia releases (per sample) were:

Average: 0.797 lb
Maximum: 42.875 lb.

A mean rate was calculated as 0.798 lb/d. The total amount of ammonia released from the Evaporator Vessel Vent Stack in 1989 was 59 lb (the 1988 quantity was 200 lb).

Table 4-5. Stack 296-A-22 Gaseous Radioactive Effluent Inventory at Risk.

Emission	Maximum (μCi/mL)	Annual release w/Controls (Ci)	Annual release w/o Controls (Ci)	CAP-88 Conversion factor	CAP-88 Offsite dose (mrem)
^{137}Cs	1 E-14	1.03 E-07	0.0003	2.39 E-02	7.39 E-06
^{129}I	2 E-11	2.06 E-04	0.62	2.91 E-01	0.18
^{106}Ru	2 E-10	2.06 E-03	6.18	2.09 E-02	0.13
^{103}Ru	4 E-14	4.12 E-7	0.0012	1.42 E-03	1.76 E-6
^{113}Sn	4 E-13	4.12 E-06	0.012	1.18 E-03	1.46 E-05
$^{89,90}Sr$	4 E-14	4.12 E-07	0.0012	4.38 E-02[c]	0.0001
^{125}Sb	1.0 E-11	1.03 E-04	0.31	4.15 E-03	0.0013
Total offsite dose					0.311

[c]Conversion factor good for ^{90}Sr only. ^{89}Sr not listed.

Table 4-6. Stack 296-A-22 Gaseous Nonradioactive Effluents.

Chemical	Emission rate at maximum concentration of process condensate (lb/h)	Maximum daily emission rate (kg/24 h)	CERCLA reportable quantity (kg)
Acetone	2.42 E-2	0.2640	2,270
1-Butanol or Butyl Alcohol	1.817 E-1	1.9822	2,270
2-Hexanone	8.727 E-5	0.0010	none
Methyl Isobutyl Ketone (MIBK-Hexone)	1.654 E-3	0.0180	2,270

4.4.2 242-A Evaporator Building Ventilation

Airborne effluents from the building process and support zones are discharged to the atmosphere via the 296-A-21 building ventilation stack. Table 4-7 contains radionuclide emission data from this stack from data obtained from the following sources:

WHC-SD-WM-SAR-023, *242-A Evaporator Safety Analysis Report* (WHC 1988)

WHC-EP-0141, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987: 200/600 Areas* (Brown 1988)

WHC-EP-0141-1, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas* (Brown 1989)

WHC-EP-0141-2, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas* (Brown 1990).

Table 4-7 contains the maximum offsite dose that could result from the data given in the referenced sources. Because specific radionuclide emission data are not presented in the referenced sources for all years, a direct determination of the maximum curie release for 1 yr, by simple comparison, was not judicious. Likewise, a comparison of 1988 and 1989 values was not prudent because the evaporator did not operate for all of 1989. As a result, the derivation in the maximum radionuclide amount (curies) released for a year presented in Table 4-7 was determined in the following way:

First, the maximum annual volumetric flow was utilized from all the years listed (total volume = $2.90 \times 10^{+11}$ L)

Second, the maximum specific radionuclide concentration that was discharged was used

Finally, these two values multiplied together, giving the maximum possible total release, in curies, that could result using the data furnished in Table 4-8.

The "Annual release w/controls" column presents these calculations. The "Annual release w/o controls" column gives the values that could result if the HEPA filters were not in place. This value is 3,000 time the previous columns' values. The multiplication factor of 3,000 is based on a 99.97% HEPA filter efficiency and is an accepted factor to determine a worst-case release scenario. The CAP-88 (Beres 1990) conversion factor is from an approved EPA computer modeling program.

Table 4-7. Stack 296-A-21 Gaseous Radioactive Effluent Inventory at Risk.

Emission	Maximum (μCi/mL)	Annual release w/controls (Ci)	Annual release w/o controls (Ci)	CAP-88 Conversion factor	CAP-88 Offsite dose (mrem)
^{241}Am	2.2 E-14	6.38 E-06	0.0191	13.1	0.25
$^{239,240}Pu$	1.5 E-15	4.35 E-07	0.0013	8.67	0.0113
Total offsite dose					0.2613

4.4.3 242-A Evaporator Steam Condensate

Radionuclide source term data for the 242-A Evaporator steam condensate stream are compiled in Table 4-8. These data were taken from the following referenced documents:

WHC-EP-0141, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987: 200/600 Areas* (Brown 1988)

WHC-EP-0141-1, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas* (Brown 1989)

WHC-EP-0141-2, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas* (Brown 1990)

WHC-SD-WM-SAR-023, *242-A Evaporator Safety Analysis Report* (WHC 1988)

WHC-EP-0342, Addendum 26, *242-A Evaporator Steam Condensate Stream-Specific Report* (WHC 1990c).

Table 4-8 lists the maximum value that was contained in the referenced sources. In this table, the maximum radionuclide releases, during a day were calculated in curies. This was done by taking the maximum recorded flow for the year ($8.5 \times 10^{+07}$ L). This figure divided by 365 gives a daily flow rate of 232,876 L. This was then used to fill in the figures in the last column.

Table 4-9 contains the nonradionuclide source term for the 242-A steam condensate stream. The data in this table were obtained from WHC-EP-0342, Addendum 26, *242-A Evaporator Steam Condensate Stream-Specific Report* (WHC 1990c).

Table 4-8. Steam Condensate Radionuclide Source Terms.

Effluent	Maximum (μCi/mL)	Maximum 24-h release (Ci)
Alpha	9.1 E-09	2.12 E-06
Beta	8.5 E-08	1.98 E-05
^{14}C	4.5 E-09	1.05 E-06
^{3}H	1.2 E-04	0.028
^{137}Cs	7 E-08	1.63 E-05
Uranium	2.9 E-09	6.75 E-07
^{234}U	2.01 E-10	4.68 E-08
^{238}U	1.78 E-10	4.14 E-08
$^{239,240}Pu$	1.3 E-08	3.03 E-06
$^{89,90}Sr$	2 E-08	4.66 E-06

Table 4-9. Steam Condensate Nonradionuclide Source Terms. (2 Sheets)

Chemical	Concentration (ppb)	Daily release rate (kg/d)	CERCLA reportable quantity (kg/d)
Aluminum	180	0.042	none
Ammonia	81	0.019	45.4
Arsenic (EP Toxic)	500	0.12	0.454
Barium	33	0.0077	454
Barium (EP Toxic)	1,000	0.23	454
Boron	23	0.0054	none
Calcium	20,700	4.82	none
Cadmium	4	0.0009	4.54
Cadmium (EP Toxic)	100	0.023	4.54
Chloride (Cl-)	1,300	0.30	none
Chromium	10	0.0023	2,270
Chromium (EP Toxic)	500	0.1164	2,270
Copper	13	0.0030	2,270
Fluoride (F-)	132	0.031	none
Iron	211	0.049	none
Lead (EP Toxic)	500	0.1164	0.454
Lead	7	0.0016	0.454
Magnesium	4,710	1.097	none
Manganese	42	0.0098	none

Table 4-9. Steam Condensate Nonradionuclide Source Terms. (2 Sheets)

Chemical	Concentration (ppb)	Daily release rate (kg/d)	CERCLA reportable quantity (kg/d)
Mercury (EP Toxic)	20	0.0047	0.454
Mercury	0.12	2.79 E-05	0.454
Nickel	14	0.0033	0.454
Nitrate (NO_3-)	600	0.14	none
Potassium	827	0.19	none
Selenium (EP Toxic)	500	0.12	45.4
Silicon	2,690	0.63	none
Silver (EP Toxic)	500	0.12	454
Sodium	2,340	0.54	4.54
Strontium	102	0.024	none
Sulfate (SO_4)	10,800	2.52	none
Uranium	0.621	0.0001	45.5
Zinc	29	0.0068	454
2-Butanone or Methylethyl Ketone	18	0.0042	2,270
Dichloromethane	170	0.040	none
Phenol	35	0.0082	454
Tetra-hydrofuran	17	0.0040	454

The maximum total yearly flow (as supplied by the references) of $8.5 \times 10^{+07}$ L was used. This figure divided by 365 will give a daily flow rate of 232,876 L/d. This figure was used to determine if the CERCLA RQ values are violated.

4.4.4 242-A EVAPORATOR COOLING WATER

Cooling water passes through the cooling tubes of the primary condenser at a maximum flow rate of 3,500 gal/min. Cooling water for the inter- and after-condensers flows at a rate of approximately 150 gal/min. This flow of used raw water is combined with the used raw water from the primary condenser and drains to B Pond. A small amount of this flow is first routed through the R-C-2 sampler and monitor before draining to the pond. The total maximum flow is (3,500 + 150) 3,650 gal/min. Other smaller streams flowing into the waste cooling water 24-in.-dia. pipe come from the HVAC equipment floor drains, steam condensate from the steam turbine, the drip pans of the raw water filters, the HVAC relief valve condensate lines, the HVAC steam condensate traps, the air compressor cooling water, the compressed air after-cooler heat exchanger, and the compressed air separator.

Table 4-10 contains the radionuclide source terms for the used cooling water wastestream. These data were obtained from the following sources:

WHC-EP-0141, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987: 200/600 Areas* (Brown 1988)

WHC-EP-0141-1, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas* (Brown 1989)

WHC-EP-0141-2, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas* (Brown 1990)

WHC-SD-WM-SAR-023, *242-A Evaporator Safety Analysis Report* (WHC 1988)

WHC-EP-0342, Addendum 21, *242-A Evaporator Cooling Water Stream-Specific Report* (WHC 1990d).

From these data, the maximum curies released during a day were calculated. This was done by taking the maximum total yearly flow of $6.34 \times 10^{+09}$ L. This figure divided by 365 gives a flow rate of 17,369,863 L/d.

Table 4-11 contains the nonradionuclide data for the used cooling water wastestream. The data in this table were obtained from WHC-EP-0342, Addendum 21, *242-A Evaporator Cooling Water Stream-Specific Report* (WHC 1990d).

The total yearly flow used was $6.34 \times 10^{+09}$ L. This figure divided by 365 gives a daily flow rate of 17,369,863 L/d. This figure was used to determine whether the CERCLA RQ values are violated.

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Table 4-11. Cooling Water Nonradionuclide Source Term. (2 sheets)

Chemical	Concentration (ppb)	Daily release rate (kg)	CERCLA reportable quantity (kg)
Uranium	0.767	0.0133	45.4
Zinc	67	1.16	454
1-Butanol	11	0.19	2,270
Dichloromethane	170	2.95	none

*Represents that this constituent is over the CERCLA RQ value. See Raw Water Data in Table 4-9.

4.4.5 242-A Evaporator Raw Water

Table 4-12 contains the nonradionuclide data for the raw water. The data in this table were obtained from WHC-EP-0342, Addendum 21, *242-A Evaporator Cooling Water Stream-Specific Report* (WHC 1990d).

Using the maximum total yearly flow of 6.34 x 10^{+09} L divided by 365 gives a flow rate of 17,369,863 L/d. This figure was used to determine if the CERCLA RQ values are violated.

Because the raw water quantities of sodium are reportable under CERCLA, and because the cooling water quantities are similar to the raw water quantities, it is reasonable to assume that no further addition of the regulated constituent was or is added during the Evaporator process. These quantities are compared in Table 4-13. It can therefore be concluded that these discharges are not regulated as RQs under CERCLA.

Table 4-10. Cooling Water Radionuclide Source Term.

Effluent	Maximum (μCi/mL)	Maximum potential 24 h release (Ci)
Alpha	6.9 E-09	
Beta	9.4 E-08	
^{3}H	5 E-05	0.8685
^{137}Cs	6 E-08	0.0010
$^{239,240}Pu$	1.7 E-08	0.0003
$^{89,90}Sr$	2 E-08	0.0003

Table 4-11. Cooling Water Nonradionuclide Source Term. (2 sheets)

Chemical	Concentration (ppb)	Daily release rate (kg)	CERCLA reportable quantity (kg)
Barium	32	0.558	454
Calcium	21,200	368.24	none
Cadmium	2	0.35	4.54
Chloride (Cl-)	1,070	18.6	none
Chromium	12	0.21	2,270
Copper	97	1.68	2,270
Iron	194	3.37	none
Lead	15.8	0.27	0.454
Magnesium	4,860	84.42	none
Manganese	20	0.35	none
Nickel	16	0.28	0.454
Nitrate (NO_3-)	3,620	62.88	none
Potassium	840	14.59	none
Sodium	2,680	46.55*	4.54
Sulfate (SO_4)	11,500	199.75	none

5.0 POTENTIAL UPSET-OPERATING CONDITION

No potential upset conditions have been identified or deemed credible. No mechanisms were identified for routine release of radionuclides offsite from the 242-A Evaporator Facility. Therefore, no analyses were performed for operational radiological impact to the offsite population. Ecological impacts from this facility are essentially unchanged from present conditions.

Table 4-12. Raw Water Nonradionuclide Source Term.

Chemical	Concentration (ppb)	Daily release rate (kg)	CERCLA reportable quantity (kg)
Barium	28	0.49	454
Calcium	18,400	319.6	none
Cadmium	2.4	0.042	4.54
Chloride (Cl-)	871	15.12	none
Copper	10.6	0.18	2,270
Iron	63.6	1.10	none
Magnesium	4,190	72.78	none
Manganese	9.8	0.017	none
Nickel	10.4	0.18	0.454
Nitrate (NO_3-)	996	17.3	none
Potassium	795	13.81	none
Sodium	2,260	39.26*	4.54
Sulfate (SO_4)	10,600	184.12	none
Uranium	0.726	0.013	45.4
Zinc	20	0.35	454
Trichloromethane	11.8	0.21	2,270
Alpha (μCi/mL)	8.85 E-10	NA	NA
Beta (μCi/mL)	4.47 E-09	NA	NA

*Represents that this constituent is over the CERCLA RQ value.

Table 4-13. Raw Water/Cooling Water CERCLA RQ Comparison.

Constituent	24-h Raw water quantity supplied (kg)	24-h Cooling water quantity released (kg)
Sodium	39.26	46.55

6.0 SUMMARY

Based on the information gathered here, the 242-A Evaporator requires a FEMP for the main stack, 296-A-22, because either the potential emissions or inventories at risk, or both, are greater than the EPA criteria.

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7.0 REFERENCES

Beres, D. A., 1990, *The Clean Air Act Assessment Package - 1988* (CAP 88). *A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air*, Vols 1-3, U.S. Environmental Protection Agency, Washington, D.C.

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Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended 42 USC 251.

DOE/RL, 1990, *Evaporator Dangerous Waste Permit Application*, DOE/RL-90-42, U.S. Department of Energy - Richland Operations Office, Richland, Washington.

EPA, 1989a, "Designation, Reportable Quantities, and Notification," Title 40, Code of Federal Regulations, Part 302, U.S. Environmental Protection Agency, Washington, D.C.

WAC, 1989a, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington.

WHC, 1988, *242-A Evaporator/Crystallizer Safety Analysis Report*, WHC-SD-WM-SAR-023, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Methods and Data for Use in Determining Source Terms for the Grout Disposal Program*, WHC-SD-WM-TI-355, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *242-A Evaporator Process Condensate Stream-Specific Report*, WHC-EP-0342, Addendum 15, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990c, *242-A Evaporator Steam Condensate Stream-Specific Report*, WHC-EP-0342, Addendum 26, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990d, *242-A Evaporator Cooling Water Stream-Specific Report*, WHC-EP-0342, Addendum 21, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, *Hazard Classification*, WHC-SD-WM-PSE-008, Westinghouse Hanford Company, Richland, Washington.

ATTACHMENT 1

296-A-22 STACK

FACILITY EFFLUENT MONITORING PLAN

DETERMINATION

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ATTACHMENT 1-1
DETERMINATION FACILITY EFFLUENT
MONITORING PLAN REQUIREMENT

FACILITY 242-A Evaporator Vessel Vent DISCHARGE POINT 296-A-22

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/chemical form	Quantity released w/controls (Ci)	Quantity released w/o controls (mrem)	Projected offsite dose w/o controls (mrem)
1. ^{137}Cs	Particulate	1.03 E-07	0.0003	7.39 E-06
1. ^{129}I	Gaseous	2.06 E-04	0.62	0.18
3. ^{106}Ru	Gaseous	2.06 E-03	6.18	0.13
4. ^{103}Ru	Gaseous	4.12 E-7	0.0012	1.76 E-6
5. ^{113}Sn	Gaseous	4.12 E-06	0.012	1.46 E-05
6. $^{89,90}Sr$	Particulate	4.12 E-07	0.0012	0.0001
7. ^{125}Sb	Gaseous	1.03 E-04	0.31	0.0013
Total Offsite Effective Dose Equivalent				0.311*

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated Material	Quantity (lb)	Quantity released (lb/24 h)	Reportable quantity (lb/d)	% of Reportable quantity
1. Ammonia	1,576	42.9	100	43
2. Acetone	42.9	0.58	5,000	0.01
3. 1-Butanol or Butyl Alcohol	87.1	4.4	5,000	0.09
4. Methyl Isobutyl Ketone (MIBK-Hexone)	0.05	0.04	5,000	0.001

Attachment 1-1 (cont.)

Identification of Reference Material

Organic emission calculations supplied by Westinghouse Environmental and Geotechnical Services, Inc.

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987/1988/1989: 200/600 Areas, WHC-EP-0101 /-1/-2/

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required __X__ FEMP is not required _____

EVALUATOR	Gary M Cammack	DATE	May 1, 1991
MANAGER, ENVIRONMENTAL	J M Winkler	DATE	5-1-91
FACILITY MANAGER	Joel Clark	DATE	May 1/1991

* Based on ede >0.1 mrem for single discharge point.

ATTACHMENT 1-2
DETERMINATION FACILITY EFFLUENT
MONITORING PLAN REQUIREMENT

FACILITY 242-A Evaporator Building Ventilation DISCHARGE POINT 296-A-21

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/chemical form	Quantity released w/controls (Ci)	Quantity release w/o controls (mrem)	Projected offsite dose w/o controls (mrem)
1. ^{241}Am	Particulate	6.38 E-06	0.0191	0.25
2. $^{239,240}Pu$	Particulate	4.35 E-07	0.0013	0.0113
Total Offsite Effective Dose Equivalent				0.2613*

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated Material	Quantity (lb)	Quantity released (lb/24 h)	Reportable quantity (lb/d)	% of Reportable Quantity
1. None				

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987/1988/1989: 200/600 Areas: WHC-EP-0141 /-1/-2.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required ____

EVALUATOR	[signature]	DATE	May 1, 1991
MANAGER, ENVIRONMENTAL	[signature]	DATE	5-1-91
FACILITY MANAGER	[signature]	DATE	5/1/91

* Based on ede >0.1 mrem for single discharge point.

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PART 16

242-S AND 242-T EVAPORATOR

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

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CONTENTS

LIST OF TABLES

LIST OF TERMS

AMU	aqueous make-up
CAM	continuous air monitor
CERCLA	*Comprehensive Environmental Response Compensation and Liability Act of 1980*
CFR	Code of Federal Regulations
DCRT	double contained receiver tank
DST	double-shell tank
EDE	effective dose equivalent
EPA	U.S. Environmental Protection Agency
FEMP	Facility Effluent Monitoring Plan
HEPA	high-efficiency particulate air
HVAC	heating, ventilation, and air conditioning
RQ	reportable quantity
RWP	Radiation Work Procedure
WAC	Washington Administrative Code

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242-S AND 242-T EVAPORATOR FACILITY EFFLUENT MONITORING PLAN DETERMINATION

1.0 242-S EVAPORATOR

1.1 INTRODUCTION

This document is a determination performed by Tank Farms Environmental Engineering of whether the 242-S and the 242-T Evaporator Facilities meet the criteria for requiring a Facility Effluent Monitoring Plan (FEMP). This document contains brief facility descriptions, the source term or inventory of radioactive and nonradioactive materials at the facilities, and a determination of the annual effective offsite dose that might be received by any member of the public as calculated from conversion factors generated from the U.S. Environmental Protection Agency (EPA)-approved CAP-88 (Beres 1990) computer program.

A FEMP is required if the total projected dose to any member of the public from radionuclide emissions at the facility exceeds the effective dose equivalent (EDE) of 0.1 mrem/yr from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity (RQ) as listed in 40 Code of Federal Regulations (CFR) 302.4 (EPA 1989) or is designated a Dangerous Waste in Washington Administrative Code (WAC) 173-303-70 through WAC 173-303-103 (WAC 1989) (e.g., a permitted quantity).

The conversion factors used in this evaluation to convert projected radionuclide releases to offsite doses were developed by the Pacific Northwest Laboratory. Airborne releases were assumed to occur from ground level from a central location in the 200 West. The distance from the 200 West release point to individuals at the offsite location is assumed to be 24,000 m.

Actual monitoring data were used to project the radiation dose to offsite individuals. A protection factor of 3,000 was assumed for effluent systems that were normally filtered with high-efficiency particulate air (HEPA) filters. This satisfies the EPA requirement that no engineered controls be considered in the FEMP determination.

1.2 FACILITY DESCRIPTION

The 242-S Evaporator complex, located in the 200 West Area of the Hanford Site was started up in November of 1973. The evaporator-crystallization process reduced the volume of radioactive liquid waste by evaporating water from the feed to produce a concentrated salt solution. This solution separated on cooling to form a cake and residual liquor.

The 242-S Building consists of two structural units that have been integrated into one. The unit that houses the process equipment is a steel reinforced concrete structure 74 ft long, 50 ft wide, and 62 ft above grade at

its highest point. In the process equipment building, the vessels and equipment are located in various rooms, according to their function. The liquid vapor separator and the reboiler on the evaporator loop are located in the evaporator room. Next to the evaporator room is the condenser room. This room contains the condensers, the vessel vent system, the condensate catch tank (C-100), the process condensate sampling system, the steam condensate sampling system, the cooling water sampling system, nitric acid dilution system, the process service lines, the instrument lines, and transmitters.

A small structure is attached to the building, north of the condenser room. This structure is 19 ft high with horizontal dimensions of 9 ft by 6 ft. It contains the ion exchange column used to treat the process condensate.

North of the evaporator room is the pump room. This room contains all the process jumpers and the recirculation pump. Adjacent to the pump room is the hot storage room that may be used to decontaminate equipment as well as to store spare or used equipment. Next to the hot storage room is the loading room, which is used to bring or remove equipment into or out of the building.

Immediately west of the pump room, the hot storage room, and the loading room are the aqueous makeup (AMU) room on the ground floor, and the heating, ventilation, and air conditioning (HVAC) room on the second floor. The AMU room contains the tanks and associated equipment for solution make-up, the air compressors for process and instrument air, and miscellaneous electrical switchgear. The HVAC room contains ventilation ducts, fans, air washers, filters, and other service supply system lines, such as steam and raw water.

The unit that adjoins the process building to the west is the service building. This building contains the control room, the lunch room, the change room, and storage rooms.

For more details on the 242-S Evaporator refer to RHO-CD-56-MISC *Operational Safety Analysis Report 242-S Evaporator-Crystallizer and Tank Farm Facilities* (RHO 1977).

1.3 STATUS OF OPERATION

The 242-S Evaporator operated very successfully until shutdown in November 1980. The evaporator boiled off nearly 42 M gal of water and produced about 12 M gal of wet saltcake. The 242-S Evaporator was placed in Shutdown/Standby Condition II in 1981, which included flushing and removing radioactive liquids from the facility. Because of future waste volume projections made at that time, in RHO-CD-80-615, *Tank Farm Waste Volume Projections*, the facility was upgraded by adding a pumpout system, by which the evaporator vessel could be pumped out to a double-shell tank (DST) in case of a shutdown during operation.

By 1985, no restart requirement had appeared, so the 242-S Evaporator was placed in Standby/Shutdown Condition III. This condition means that the building will be maintained in such a manner that it can be restarted, recognizing that the startup time would be greater than 6 mo.

In 1985, a transfer was made through the 242-S ion exchange column to reduce the uranium content in the U-1/U-2 Crib groundwater. The transfer was sent through the 302-C Tank and then through the ion exchange column. The C-100 Condensate Catch Tank was used during column regeneration. The project was shutdown for the winter and never resumed. Funding was never designated for this use of the 242-S Evaporator.

1.4 SOURCE TERM

1.4.1 Facility Effluent Discharges

After the shutdown activities, which included extensive decontamination of the facility, very few paths for liquid intrusion into the 242-S Condenser Room and the hot side of the building remained. Active sources of water intrusion into the condenser room and other areas of the hot side are from the following:

- The fire suppression sprinklers
- The safety shower water supply
- The filtered raw water to the PB-1 and PB-2 Pumps.

NOTE: The "hot" (radioactively contaminated) area is generally considered to be the following rooms:

- Condenser room
- Pump room
- Evaporator room
- Ion exchange room
- Loading room
- Hot equipment storage room.

The condenser room and other areas of the hot side are also subject to intrusion from external sources, such as snow melt running under the truck loadout room door, or water from the fire sprinklers in the AMU room.

Any intrusion into the hot side (except in the condenser room) will drain to the pump room sump, where it will be jetted to DST 241-SY-102. In the condenser room, small amounts of liquid will either be mopped up or left to accumulate in the condenser room sump. Large accumulations of water will accumulate in the condenser room sump and be pumped into tank C-100 (located in the condenser room) where it will be sampled. If the liquid is within radiological release limits, it will be pumped into the C-103 Weir Box and sent to the U-14 Ditch. If the liquid is not within the release limits, it will be pumped to the pump room sump and jetted into the 241-SY-102 Tank. A minimum liquid heel is always maintained in the C-100 Tank to minimize any tendency for a large intrusion to float the tank.

The following are the identified effluent discharge sources for the 242-S Evaporator Facility:

Clean Streams. None of these streams are monitored or sampled.

- Service Area Room Air. This is a gaseous release to the environment. The service area (control, change, lunch, AMU, and HVAC rooms) is pressurized positive to the atmosphere. Air is exhausted from these areas by the K2-5-2 and K2-8-2 fans and by outleakage.

- Exhaust Turbine Building. This liquid stream is discharged to the U-14 Ditch. It consists of steam condensate (from the building heater, the steam turbine, and steam traps) and the turbine cooling water.

- AMU and HVAC Rooms. This liquid stream is discharged to the U-14 Ditch. It consists of steam condensate and used water from the heating and ventilation equipment and cooling water and condensate blowdown from the building air compressors.

- Lunch Room and Restroom. This stream is discharged to a sanitary septic tank and seepage pit. It consists of drainage from the lunch room sink, restroom sinks, shower, and lavatory.

Potentially Contaminated Effluent Streams. All these streams are continuously monitored and sampled.

- Building Exhaust Stack (296-S-18). This is a gaseous release filtered through a series of HEPA filters before being discharged to the environment through the 242-S Evaporator Building Ventilation Stack. This stack is the discharge point for the building process area: the evaporator room, the pump room, the hot storage room, the loadout room, the condenser room, and the ion exchange room. The discharge through this stack is continuously monitored with an alpha continuous air monitor (CAM), and a beta-gamma CAM. It is, also, sampled with a Record Sampler. The record sampler filter paper is exchanged weekly and sent to the 222-S Laboratory. The results are reported to the Environmental Protection Group, who publishes them annually in the *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report*.

- RC-1 Steam Condensate. This liquid stream is collected in the C-103 Tank Weir Box and is then sent to the U-14 Ditch. The only active source to this stream is the AS-1 air sample pump seal water. This stream is continuously monitored and sampled.

- Vessel Vent Exhaust Stack (296-S-19). This is a gaseous release filtered through a series of HEPA filters before being discharged to the environment through the 242-S Vessel Vent Stack. The only active source to this release point is the air exhausted from the AS-1 air sample pump. It is planned to reroute this effluent stream through the Building Ventilation Exhaust Stack. After this reroute is accomplished the Vessel Vent Stack will be sealed from the

environment and this effluent stream will no longer exist. The stream is currently continuously monitored by Victorine Continuous Monitoring Stations in combination with the Building Ventilation Exhaust Stack Sampling System. The means of monitoring this stream will become evident in the next few paragraphs.

The Air Sampler pump is a vacuum pump that draws air through Victorine-type continuous monitoring stations located in various rooms of the Evaporator facility. These monitoring stations identify abnormal levels of airborne radioactive materials. These monitoring stations are located in rooms that include the condenser room, aqueous make-up room, clothes changeroom, and control room. The monitors consist of a filter paper monitored by a beta-gamma radiation detector. As air is drawn through the filter paper, airborne radioactive particulates are collected. When the detector senses a predetermined radiation level above background, an alarm is activated. The alarm identifies radioactive airborne contamination within the room in question. The filter papers used in these monitors are exchanged weekly and delivered to the 222-S Laboratory for gross alpha and beta analysis. Any abnormal results are reported to the Health and Safety Group.

The Air Sampler Pump gaseous effluent stream, which is discharged through the Vessel Vent Stack, is monitored as follows:

- The air that is pulled through the air sampler pump is first monitored by the various air sampling stations.

- The air sampler pump is located in the condenser room. Air that is not being pulled through the sampling stations may leak into the sampler pump. Therefore, it is necessary to show this additional air is being monitored. This leakage would necessarily come from the condenser room. Because an air monitoring station is located in this room, a representative portion of the air that would contribute to any leakage would be monitored by this particular station.

  Finally, the Condenser Room is ventilated through the Building Ventilation Stack. Therefore, a representative portion of the air that would contribute to any leakage into the sampler pump would also be monitored by the Building Ventilation Stack Sampling System.

Raw water is used in the air sampler pump to maintain a positive water seal within the pump. The raw water is supplied from the Columbia River via the 200 West Area Powerhouse. The water is supplied to the air sampler pump seal at a rate of 350 to 600 gal/h. After leaving the vacuum pump, the water flows through a 500-gal flow-measuring weir (TK-C-103), which signals a proportional sampler (the RC1 sampler system) to take a sample after a certain volume of water has passed over it. When the proportional sampler is not operational, dip samples are taken daily for laboratory analysis.

From the flow-measuring weir, the stream flows out a 4-in.-dia. pipe to a two-way diversion valve. This valve diverts the stream flow to the 216-U-14 Ditch during normal operations. This valve is also capable of diverting the flow to the C-100 Tank (located in the 242-S Evaporator condenser room) in case of an upset condition.

A radiation (gamma) monitor is in place as part of the RC1 sampling system. This detector is used to identify any potential leaks of radioactive material into the wastestream. If radiation is detected by the gamma monitor above a predetermined setpoint, a signal is sent to the two-way diversion valve to cause the flow to be diverted to the C-100 Tank. This prevents discharge of the stream to the 216-U-14 Ditch until the radiation contamination has been identified and the cause of the contamination corrected. Waste diverted to the C-100 Tank is eventually pumped to a DST in the SY Tank Farm.

Currently, an engineering change is being written to replace the sampler pump with a pump which will not require seal water. When this new pump is installed, this effluent stream will no longer exist.

Chemical data for the 242-S Evaporator were obtained from the *242-S Evaporator Steam Condensate Stream-Specific Report*, WHC-EP-0342, Addendum 29 (WHC 1990a). The chemical data samples were taken at the RC1 sampler in the 242-S Evaporator Condenser Room. Four samples were taken, one each on October 26, 1989, November 30, 1989, January 31, 1990, and March 16, 1990. Sampling data was also conducted between October 24, 1986, and May 22, 1987. These samples were all taken under the current process configuration and are therefore representative of the overall stream configuration.

Table 1-1 contains the maximum concentration for each of the nonradionuclide constituents that were tabulated in the available data. To determine if any Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA)-RQ are being discharged, the concentration of each constituent is multiplied by the maximum flow rate of the stream. For 600 gal/h, the quantity of air sampler pump seal water discharged per day equates to 14,400 gal. As Table 1-1 shows, no CERCLA-RQ values are being violated.

Table 1-2 contains the maximum concentration for each radionuclide constituent that was tabulated in the available data for the air sampler pump seal water that is discharged.

1.4.2 Inventory At Risk

Table 1-3 contains data that was supplied in WHC-EP-0141-2, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas* (Brown 1990). The "ANNUAL RELEASE With Controls" column represents these values multiplied by the total annual volumetric flow ($2.89 \times 10^{+11}$), which was also supplied in the reference. The "ANNUAL RELEASE Without Controls" column give the values that could result if the HEPA filers were not in place. This value is 3,000 times the previous column's values. The multiplication factor of 3,000 is based on a 99.97% HEPA filter efficiency and is an accepted factor to determine a worst case release scenario. The CAP-88 (Beres 1990) conversion factor is from an approved EPA computer modeling program. The information presented in this table is repeated in Attachment 1.

Table 1-1. 242-S Nonradionuclide Source Term. (2 Sheets)

Chemical	Maximum concentration (ppb)	Maximum 24-h quantity released (kg)	CERCLA reportable quantity (kg)
Ammonia	54	7.78 E-04	45.4
Arsenic (EP Toxic)	500	7.2 E-03	0.454
Barium (EP Toxic)	1,000	1.44 E-02	454
Barium	32	4.61 E-04	454
Boron	23	3.31 E-04	no RQ
Cadmium (EP Toxic)	100	1.44 E-03	4.54
Calcium	20,600	0.297	no RQ
Chloride	5,500	7.92 E-02	no RQ
Chromium (EP Toxic)	500	7.2 E-03	2,270
Copper	13	1.87 E-04	2,270
Fluoride	1,000	1.44 E-04	no RQ
Iron	71	1.02 E-03	no RQ
Lead (EP Toxic)	500	7.2 E-03	0.454
Magnesium	4,690	6.75 E-02	no RQ
Manganese	22	3.17 E-04	no RQ
Mercury (EP Toxic)	20	2.88 E-04	0.454
Nitrate	604	8.70 E-04	no RQ
Potassium	960	1.38 E-02	no RQ
Selenium (EP Toxic)	500	7.2 E-03	45.4
Silicon	2,320	3.34 E-02	no RQ
Silver (EP Toxic)	500	7.2 E-03	454
Sodium	2,460	3.54 E-02	4.54
Strontium	300	4.32 E-03	no RQ
Sulfate	17,500	0.25	no RQ

Table 1-1. 242-S Nonradionuclide Source Term. (2 Sheets)

Chemical	Maximum concentration (ppb)	Maximum 24-h quantity released (kg)	CERCLA reportable quantity (kg)
Sulfide	1,040	1.50 E-02	no RQ
Uranium	0.519	7.47 E-06	45.4
Zinc	97	1.40 E-03	454
Acetone	16	2.3 E-04	2,270
2-Butanone or Methylethyl Ketone	10	1.44 E-04	2,270
Chloroform or 1,1,1-Tri-chloromethane	27	3.89 E-04	4.54
Dichloromethane	55	7.92 E-04	no RQ
Tetrahydrofuran	17	2.45 E-04	454

Table 1-2. 242-S Evaporator Radionuclide Source Term.

Effluent	Maximum (μCi/Ml)
Alpha	1.29 E-09
Beta	7.8 E-09
^{60}Co	1.03 E-09
^{90}Sr	2.93 E-08
^{234}U	1.89 E-08
^{238}U	1.17 E-08

Table 1-3. Stack 296-S-18 Gaseous Radioactive Effluent Inventory at Risk.

Emission	Maximum (μCi/mL)	Annual release with controls (Ci)	Annual release without controls (Ci)	CAP-88 conversion factor	CAP-88 offsite dose (mrem)
Alpha	4.02 E-15	1.16 E-06	3.48 E-03	5.15	1.79 E-02
Beta	1.40 E-14	4.04 E-06	1.21 E-02	0.026	3.15 E-04
Total offsite dose					1.82 E-02

1.5 POTENTIAL UPSET-OPERATING CONDITIONS

No potential upset operating conditions have been identified or deemed credible. No mechanisms were identified for routine release of any radionuclides offsite and, therefore, no analyses were performed for operational radiological impact to the offsite population. Ecological impacts from this facility are essentially unchanged from present conditions.

1.6 SUMMARY

Based on the information presented here, the 242-S Evaporator does not require a FEMP.

2.0 242-T EVAPORATOR FACILITY

2.1 INTRODUCTION

The 242-T Evaporator Facility, located in the 200 West Area of the Hanford Site (between TY and TX Tank Farms) was constructed in the early 1950's. The facility was operated as a batch evaporator unit until its shutdown in 1955.

In 1965, the 242-T Evaporator Facility was modified. The evaporator was restarted that same year and operated as a continuous evaporation process. During 1973 more modifications were made. The facility was then used to neutralize and concentrate high and low salt acid waste from the Plutonium Finishing Plant (Z Plant). This configuration continued from 1973 until 1976, when the 242-T Evaporator Facility was once again shutdown.

Following this shutdown, a new Receiver Tank (R-1) was built. This receiver tank was used only for neutralizing Z Plant acid waste. This new operation continued until November of 1980. Use of the 242-T Facility in this capacity was concluded with the anticipated startup of the 244-TX Double Contained Receiver Tank (DCRT) which was completed in the spring of 1981. The 244-TX DCRT was built to replace the R-1 Receiver Tank in the Receiver Vault.

2.2 FACILITY DESCRIPTION

The 242-T Evaporator Facility is divided into a processing area and a control area. The process area includes the 242-T Building, the 242-TA Vault, and the 242-TB Ventilation Building. The control area is contained in the metal building adjacent to the east wall of the 242-T Building.

The 242-T Building is a steel reinforced concrete structure 48 ft long, 42 ft wide, and 23 ft high. The building contains the Condensate Area, the Feed Cell, and the Evaporator Area. The Feed Cell houses the 4,000-gal B-1 Blend Tank plus the interconnecting piping between this tank, the evaporator vessel, and the 241-TX Tank Farm. The Evaporator Area (called the hot cell) contains the evaporator vessel, a cyclone separator, the cyclone

separator catch tank, two evaporator feed preheaters, a floor sump, and interconnecting piping between the feed and cold cells and the TX Tank Farm. The Condensate Area (called the cold cell) contains two 4,000-gal condensate catch tanks, a scrubber, condenser, floor sump, and interconnecting piping between the feed and hot cells and the TX Tank Farm.

The 242-TA Vault is a concrete-lined pit with a ground-level steel cover. The 4,000 gal R-1 Receiver Tank and the piping connecting it to the feed cell are inside this vault. Acetic high-level waste from Z Plant flowed into this tank for pumpage to the feed cell.

The 242-TB Ventilation Building contains the ventilation equipment and instruments for the TB ventilation system. This ventilation system services the R-1 Receiver Tank and the TA Vault.

The control area consists of an operating room, a radiation/contamination control room, a lunch room, and a lavatory. The operating room contains instrumentation for the 242-T Building and much of the process control equipment for the 241-TX Tank Farm. The operating room will also house the instrumentation for the Salt Well Pumping Program. The radiation/contamination control room provides storage for Radiation Work Procedure (RWP) Clothing, is a shielded radiation survey area for people leaving the radiation zone, and acts as a change room.

Three HEPA-filtered ventilation exhaust systems are in place at the 242-T Evaporator Facility. The smallest system (the Vessel Ventilation System) was built to exhaust the following:

- The two catch tanks in the Condensate Area
- The evaporator vessel and attached cyclone separator, catch tank, two-feed preheater tanks, and interconnecting piping.

The exhauster is located at the east wall of the Condensate Area, just downstream of the filters. This system is no longer in service.

A second exhaust system is housed inside the 242-TB Building. It was built to vent the following:

- The 242-TA Vault and the R-1 Receiver Tank
- The Feed Cell B-1 Tank
- The Feed Cell
- The Evaporator Area.

The 242-TB exhaust system is currently shutdown as well.

The third and largest HEPA-filtered ventilation exhaust system is powered by one of two electric fans, each rated at 2,000 ft^3/min. The stack is 1 ft in diameter and 15 ft high. The system includes an inlet plenum, a preheater for the inlet air, and two HEPA filters upstream of the fan. A reserve bank

of HEPA filters parallels the system. The electric heater heats the air above saturation to prevent water damage to the HEPA filters. This system currently exhausts the following:

- The Evaporator Area (the hot area)
- The Feed Cell, through the Evaporator Area
- The Condensate Area (the cold area), separately, but at a lower vacuum flow.

This is the only operating exhaust system for the process areas and is normally operated at a flow rate of 1,500 ft^3/min or less.

For a more detailed discussion on the 242-T Evaporator refer to SD-HS-SAR-009, *242-T Evaporator Facility Shutdown/Standby to Condition V Safety Analysis Report* (WHC 1983).

2.3 STATUS OF OPERATION

With the shutdown that occurred in 1980, process-area operation was no longer required and the areas were placed in Shutdown/Standby Condition V. This condition means that no further operational requirement existed. Because of contamination conditions and continued security needs, the facility could not be declared as excess. Usable equipment in the facility would be available, though, for transfer for any other known uses on the Hanford Site. Surveillance requirements would be addressed via special surveillance procedures before completion of preparatory shutdown/standby activities.

The control room area of the 242-T Evaporator Facility continued to be used in support of the Salt Well Pumping Program (the stabilization of the single shell tanks).

For purposes of this FEMP Determination the shutdown/standby activities that were accomplished are the following:

- 242-TA Receiver Vault. The R-1 Receiver Tank was isolated.
- 242-T Feed Cell. The B-1 Blend Tank in the Feed Cell was configured to received liquid from the hot cell sump. A pump-out system was installed to remove the liquid accumulated in this tank to the Tank Farms.
- 242-T Hot Cell. The 242-T Evaporator was chemically flushed in 1976. Because of the extremely high radiation levels (9 RAD) within the hot cell, no effort was made to decontaminate it or the equipment inside. Line blanking and instrument disabling were, however, performed just outside this room. The hot cell jet pump and associated gang valve system was left functioning to jet accumulated liquids to the B-1 Blend Tank.

- 242-T Cold Cell

  - The cold cell was decontaminated to a level where entry could be made without a mask.

  - A 50-ft^3/min capacity HEPA filter was placed on the Vessel Ventilation system to serve as a breather filter for the condensate catch tanks.

  - The vessel ventilation stack sampler and associated radiation alarm switches, alarms, and sensing elements were disabled. The Vessel Ventilation Exhauster was also disconnected.

  - The condensate catch tanks were continued as collection vessels for liquids jetted from the 242-T Cold Cell Sump. The accumulated liquid is subsequently transferred to DST TK 102-SY.

- The Building Ventilation System

  - The building ventilation system is currently operated to reduce hazards associated with airborne radioactivity at the 242-T Evaporator Facility. The building ventilation system has sufficient capacity to maintain the required negative pressure in the cold area, the hot area, and the feed cells.

  - The steam to the building ventilation HEPA-filter preheater was turned off. The condensate return line was rerouted to the cold cell sump, which is subsequently transferred to the condensate catch tanks.

- The TB Vessel Ventilation System

  - The TB ventilation system was shutdown. The system was replaced by breather filters on the R-1 Receiver Tank and the TA Vault area.

  - The TB ventilation fan was disconnected. The stack radiation monitoring/sampling system was disabled and disconnected.

Current monitoring at the 242-T Evaporator consists of CAM and alarm units in place and operating in the condensate area, the control room, and on the building ventilation exhaust stack downstream of the HEPA filters. Beta-gamma and alpha radiation monitoring/alarm capability are included in the building ventilation stack sampler system. A record sampler is also included.

2.4 SOURCE TERM

2.4.1 Facility Effluent Discharges

The only effluent released to the environment at the 242-T Evaporator Facility is the gaseous effluent released through the building ventilation exhaust stack (296-T-17).

The 242-T Evaporator Facility has no radionuclides or nonradionuclides other than those left from previous contamination.

2.4.2 Inventory At Risk

The contamination mentioned in Section 3.4 is released through the building ventilation exhaust system. The discharge through this stack is continuously monitored with an alpha CAM, and a beta-gamma CAM. It is also sampled with a record sampler. The record sampler filter paper is exchanged weekly and sent to the 222-S Laboratory. The results are reported to the Environmental Protection Group, which publishes them annually.

Table 2-1 below, contains data which was supplied in WHC-EP-0141-2, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas* (Brown 1990). The "ANNUAL RELEASE With Controls" column represents these values multiplied by the total annual volumetric flow ($3.42 \times 10^{+10}$), which was also supplied in the reference. The "ANNUAL RELEASE Without Controls" column gives the values that could result if the HEPA filters were not in place. This value is 3,000 times the previous column's values. The multiplication factor of 3,000 is based on a 99.97% HEPA filter efficiency and is an accepted factor to determine a worst-case release scenario. The CAP-88 (Beres 1990) conversion factor is from an approved EPA computer modeling program. The information presented in this table is repeated in Attachment 3-1.

Table 2-1. Stack 296-T-17 Gaseous Radioactive Effluent Inventory at Risk.

Emission	Maximum (μCi/mL)	Annual release with controls (Ci)	Annual release without controls (Ci)	CAP-88 Conversion factor	CAP-88 Offsite dose (mrem)
Alpha	3.57 E-15	1.22 E-07	3.66 E-04	5.15	1.88 E-03
Beta	1.27 E-14	4.33 E-07	1.30 E-03	0.026	3.38 E-05
Total offsite dose					1.92 E-03

Note: ^{90}Sr is used as the beta emitter.
^{239}Pu is used as the alpha emitter.

2.5 POTENTIAL UPSET-OPERATING CONDITIONS

No potential upset conditions have been identified or deemed credible. No mechanisms were identified for routine release of any radionuclides offsite and, therefore, no analyses were performed for operational radiological impact to the offsite population. Ecological impacts from this facility are essentially unchanged from present conditions.

2.6 SUMMARY

Based on the information presented here, the 242-T Evaporator does not require a FEMP.

3.0 REFERENCES

Beres, D. A., 1990, The Clean Air Act Assessment Package - 1988 (CAP-88). *A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air*, Vols. 1-3, U.S. Environmental Protection Agency, Washington, D.C.

Brown, M. J., 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*. WHC-EP-0141-2, Westinghouse Hanford Company, Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 USC 251.

EPA, 1989, "Designation, Reportable Quantities, and Notification," Title 40, Code of Federal Regulations, part 302, U.S. Environmental Protection Agency, Washington, D.C.

RHO, 1977, *Operation Safety Analysis Report 242-S Evaporator - Crystallizer and Tank Farm Facilities*, Rockwell Hanford Operations, Richland, Washington.

WAC, 1989, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington.

WHC, 1990a, *242-S Evaporator Steam Condensate Stream-Specific Report*, WHC-EP-0342, Addendum 29, Westinghouse Hanford Company, Richland, Washington.

WHC, 1983, *242-T Evaporator Facility Shutdown/Standby to Condition V Safety Analysis Report*, WHC-SD-HS-SAR-009, Westinghouse Hanford Company, Richland, Washington.

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ATTACHMENT 1

242-S EVAPORATOR

FACILITY EFFLUENT MONITORING PLAN

DETERMINATION

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Attachment 1

Determination of Facility Effluent Monitoring Plan Requirement.

FACILITY 242-S Evaporator Building Ventilation DISCHARGE POINT 296-S-18

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/ chemical form	Quantity release w/controls (Ci)	Quantity released w/o controls (Ci)	Projected offsite dose w/o controls (mrem)
1.	Alpha	Particulate	1.16 E-06	3.48 E-03	1.79 E-02
2.	Beta	Particulate	4.04 E-06	1.21 E-02	3.15 E-04
Total offsite effective dose equivalent					1.82 E-02

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated material	Quantity (lb)	Quantity released (lb/24 h)	Reportable quantity (lb/d)	% of Reportable quantity
1.	None				
Total					

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987/1988/1989: 200/600 Areas, WHC-EP-0141/-1/-2.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUA[illegible]	[signature]	DATE	May 7, 1991
MANAGER, ENVIRONMENTAL [illegible]	[signature]	DATE	5-8-91
FACILITY MANAGER	[signature]	DATE	May 7, 1991

Project Manager _____ Dat[illegible] _____

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ATTACHMENT 2

242-T EVAPORATOR

FACILITY EFFLUENT MONITORING PLAN

DETERMINATION

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Attachment 2

Determination of Facility Effluent Monitoring Plan Requirement.

FACILITY 242-T Evaporator Building Ventilation DISCHARGE POINT 296-T-17

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/ chemical form	Quantity release w/controls (Ci)	Quantity released w/o controls (Ci)	Projected offsite dose w/o controls (mrem)
1.	Alpha	Particulate	1.22 E-07	3.66 E-04	1.88 E-03
2.	Beta	Particulate	4.33 E-07	1.30 E-03	3.38 E-05
Total offsite effective dose equivalent					1.92 E-03

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated material	Quantity (lb)	Quantity released (lb/24 h)	Reportable quantity (lb/d)	% of Reportable quantity
1.	None				
Total					

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1987/1988/1989: 200/600 Areas, WHC-EP-0141/-1/-2.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required _____ FEMP is not required X

EVALUATOR	[signature]	DATE	May 7, 1991
MANAGER, ENVIRONMENTAL	[signature]	DATE	5-8-91
FACILITY MANAGER	[signature]	DATE	May 7, 1991

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PART 17

T PLANT FACILITY

FACILITY EFFLUENT MONITORING PLAN DETERMINATION

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CONTENTS

LIST OF TERMS

CAM	continuous air monitor
EDE	effective administrative code
FEMP	Facility Effluent Monitoring Plan
HEPA	high-efficiency particulate air
WAC	Washington Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company

FACILITY EFFLUENT MONITORING PLAN FOR THE T PLANT FACILITY

1.0 INTRODUCTION

This document provides information to determine if a facility effluent monitoring plan (FEMP) is required for the T Plant Facility and ancillary systems. This document has been prepared in accordance with *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans* (Guide), WHC-EP-0398 (WHC 1991a).

2.0 FACILITY DESCRIPTION/STATUS OF OPERATION

This section describes the physical characteristics of the T Plant Facility and the primary facility process.

T Plant was constructed in the mid-1940s to extract plutonium from production reactor fuel. The plant performed this function until it was deactivated in 1956. Most of the original process equipment was subsequently removed. In 1957, T Plant was placed in service as a beta-gamma decontamination facility and a support complex for experiments or other operations requiring containment or isolation. At present, it functions primarily as a decontamination facility (Hinckley 1985).

The T Plant Facility consists of two primary decontamination buildings, 221-T and 2706-T. The 221-T Building was built during 1943 and 1944 and the 2706-T Building was built during 1959 and 1960. The 2706-T Building was constructed as a low-level radioactive decontamination facility and is used to decontaminate railroad equipment, buses, trucks, automobiles, road-building equipment, and plant process equipment. Building 221-T provides services in radioactive decontamination, reclamation, and decommissioning of process equipment contaminated with fission products and other highly contaminated pieces of equipment (Hinckley 1985).

2.1 PHYSICAL DESCRIPTION

The T Plant Facility is located in the 200 West Area of the Hanford Site in the south central region of Washington State. Buildings, structures, or special facilities included as part of this FEMP are the 221-T and 2706-T Buildings, 221-T Building Head-End, and 211-T Building Chemical Storage area. Ancillary buildings and structures included are the 271-T, 291-T, and 221-TA Buildings. The decontamination process is located in the 221-T and 2706-T Buildings. Special experiments and operations are located in the 211-T Building Head-End. The 211-T Building stores chemicals when not in use. The 271-T Building provides office space to Westinghouse Hanford Company (Westinghouse Hanford) staff supporting T Plant operations. The

291-T Building houses the exhaust ventilation fans for the 291-T-1 Main Stack. The 221-TA Building houses the supply ventilation fans for the 221-T Building canyon. Liquid effluent systems and streams discussed are the 216-T-4 Chemical Sewer and Pond, including the 207-T Retention Basin, T Plant Aqueous Waste Disposal, and 216-T-1 Ditch. Airborne effluent systems and streams covered the 291-T-1 Main Stack, 296-T-13 Roof Stack, and 2706-T-7 Stack.

The 221-T Building is made of reinforced concrete and is 850 ft long by 68 ft wide by 74 ft high. The building consists of the canyon, three galleries, one crane way, and a head-end facility. Decontamination activities are performed in the canyon area, which consists of 37 cells and 1 railroad tunnel entrance/exit. The cells are in a single row running the length of the canyon with 2 cells, designated left and right, comprising a 40-ft section. The building consists of twenty 40-ft sections. The canyon deck is about 40 ft below a 3- to 4-ft thick concrete roof. Most of the cells are covered by four 6-ft-thick reinforced-concrete blocks. Cover blocks for Cells 11R, 13R, and 15R are 2 ft thick and are covered with a 3/8-in.-thick stainless steel decontamination pad. Each cover block is equipped with a lifting bail to allow the bridge crane to lift it for access to the cells. The railroad tunnel used to transport equipment into and out of the canyon, as well as for some decontamination, enters the plant at Cell 2L. A 16-ft-wide by 22-ft-high opening, covered by a motor-driven rolling steel door provides railroad canyon access.

The standard canyon cells are 17 ft 8 in. long by 13 ft wide by 28 ft deep. The cells are separated from each other by 7-ft-thick reinforced-concrete walls. All lines that service the cells are encased in concrete and terminate in a row of connector flanges on the cell wall 9 ft below canyon deck level. In some instances, process lines go directly through the wall to the adjacent cell in the same section. Because expansion joints join sections of the building, no direct through-the-wall connections run from section to section; however, all intracell liquid transfers are made through jumpers within the cells. Intersection liquid transfers are made through an 8-ft-wide by 10-ft 6-in.-deep pipe trench that runs parallel to the canyon. The trench is covered by a series of 4-ft 6-in.-thick reinforced-concrete blocks. All pipes are sloped to permit proper drainage. Any leakage into the trench area is carried via trench drains to the building's 24-in. sewer line.

Each cell slopes to a corner drain that drops into a 24-in. tile sewer line running the length of the building. The sewer line is an integral part of the building structure and empties into TK 5-7 Tank in Cell 5R. This cell also contains the 5-8 Sump (14 ft by 16 ft by 10 ft), which is the lowest point in the 221-T Building liquid waste system. Liquid wastes generated in the railroad tunnel are collected in a trench and pass via the trench drain into the 24-in. sewer line and gravity drain into the TK 5-7 Tank. Liquid wastes from the 211-T Sump are discharged to Nozzle #3 of Cell 6L where they flow into the open top of TK 6-1 Tank and overflow onto the cell floor.

From the cell floor, the wastes pass through the 6-in. floor drain into the 24-in. sewer line and gravity flow into the TK 5-7 Tank. Liquid wastes generated within Cell 12L, Cell 12R, and on the decontamination pad of Cell 13R pass via the floor drains into the 24-in. sewer line and onto the TK 5-7 Tank. The 5-8 Sump serves as a secondary containment for the

TK 5-7 Tank and for all other cells connected to the 24-in. sewer line. In the past, it was common operating practice to overflow the TK 5-7 Tank and use the 5-8 Sump as additional storage. This practice has been discontinued and is no longer allowed by procedure. Currently, any liquid collected in the 5-8 Sump is steam-jetted into the TK 5-7 Tank. Liquid collected in the TK 5-7 Tank is steam-jetted to the TK 5-9 and TK 5-6 Tanks in Cell 5L. From the TK 5-9 Tank, the waste is then jetted to the TK 15-1 Tank in Cell 15L. The TK 15-1 Tank also receives liquid waste from the decontamination pad over Cell 15R.

The wastes are treated in TK 15-1 Tank prior to transfer to 200-W Area Tank Farms. For the wastes to meet the requirement of transfer to the tank farms, three conditions must be met: the pH must be greater than 12; the level of nitrites must be greater than 600 ppm; and the waste cannot contain organics. To adjust the pH and nitrite levels, sodium hydroxide and sodium nitrite are added in appropriate quantities.

Because leakage from any part of the system within the 221-T Building is routed via drains and the 24-in. sewer line into the TK 5-7 Tank, and because any leakage from the TK 5-7 Tank is retained within the 5-8 Sump, the 5-8 Sump is considered secondary containment for the system within the 221-T Building.

2.2 STATUS OF OPERATIONS

The operational status of the T Plant Facility is fully active. The primary function or processes associated with the T Plant Facility are the decontamination and repairing of equipment. The functions or processes associated with these facilities result in the use, storage, management, and disposal of radioactive and hazardous materials. The functions or processes associated with these facilities have the potential to generate radioactive and hazardous airborne and liquid effluents.

3.0 SOURCE TERM

To assess the effluent monitoring systems needed at the T Plant Facility, the liquid and airborne effluent streams have to be identified and evaluated to quantify the radioactive and hazardous materials present. In addition, the potential for radioactive and hazardous materials to be discharged to the effluent streams during upset operating conditions will be determined.

3.1 LIQUID EFFLUENT STREAMS DISCHARGING TO THE ENVIRONMENT

The major liquid effluent streams with discharge to the environment from the T Plant Facility are described in the following paragraphs.

3.1.1 216-T-4 Chemical Sewer Pond

Liquid effluents to this effluent stream and discharge point originate from eight sources in the 221-T, 211-T, 271-T, 221-TA, 291-T, and 224-T Buildings. The effluent contributors include steam condensate, cooling water, flushing water, and other chemical streams known to not have radioactive materials. Effluents from the 211-T Building Chemical Storage Area drain directly to the 216-T-4 Pond. The other effluents drain to the 207-T Retention Basin and from there to the 216-T-4 Pond. The effluent stream is not monitored. Samples are taken for analysis of some constituents monthly and for other constituents quarterly.

3.1.2 216-T-1 Ditch

The flow from eight process sewer lines from the 221-T Building Head-End are discharged to the 216-T-1 Ditch. No effluent monitors for flowrate or constituents are in this waste stream. The effluent is sampled at the point where the 90-m underground feed pipe discharges to the 216-T-1 Ditch. When experimental operating involves process batch solutions, the effluents are collected in holding tanks, sampled for pH and routed to the 216-T-1 Ditch when the pH has been verified as acceptable.

3.2 LIQUID EFFLUENT CONTAINED WITHIN T PLANT

A third major liquid effluent stream exists at the T Plant Facility. This stream is not however, discharged to the environment. The third stream from the T Plant Facility is the T Plant Aqueous Waste Disposal Stream. Liquid effluents contributing to this effluent stream are generated during decontamination operations in the 221-T and 2706-T Buildings and drain to the TK 15-1 Tank. The liquid waste is sampled and analyzed to determine whether is meets the pH requirements for shipment and receipt at the 200 West Area Tank Farms. A calculation is performed to evaluate the quantity of enriched plutonium present.

3.3 AIRBORNE EFFLUENTS

The term gaseous effluents is used interchangeably with airborne effluent in this document. The term gaseous is not intended to exclude particulate or other solid airborne emissions. The major gaseous effluent streams from the T Plant Facility are described in the following paragraphs.

3.3.1 291-T-1 Main Stack

This stack exhausts filtered air from the 221-T Building canyon and process ventilation. Two banks of high-efficiency particulate air (HEPA) filters were installed in 1983. An isokinetic probe and sampling system consisting of a record sampler, a beta-gamma continuous air monitor (CAM) unit, and an alpha CAM unit are used to sample the effluent.

3.3.2 296-T-13 Roof Stack

This stack exhausts filtered air from the roof of the 221-T Building. The exhaust is pulled through a prefilter and two banks of HEPA filters. The effluent exhausted is from approximately 5 ft and higher above the 221-T Building canyon. The sampling and monitoring system consists of a record sampler and a beta-gamma CAM unit.

3.3.3 296-T-7 Stack

This stack exhausts unfiltered air from the 2706-T Building. The stack exhausts approximately 10 ft above the building roof level. Air is drawn from the 2706-T Building from one exhaust system for the railroad and automotive pits and three evaporative coolers located on the south wall of the building. The 296-T-7 Stack is 26 in. in diameter and 28 ft high.

4.0 POTENTIAL UPSET OPERATING CONDITIONS

4.1 NORMAL OPERATING CONDITIONS

4.1.1 Gaseous Effluents

The potential radioactive airborne effluent releases were evaluated during routine operating conditions. The 221-T Building canyon exhaust released 3.2×10^{-5} and 2.8×10^{-6} Ci of $^{239,240}Pu$ and ^{241}Am, respectively, out the 291-T-1 Main Stack during 1989 (Brown et al. 1990). Releases from this stack are filtered by two type FI-2 HEPA filter banks (Hinckley 1985). If a release fraction of 1/3,000 is assumed as the reduction attributable to the filter banks, the potential uncontrolled release would be 9.6×10^{-2} and 8.4×10^{-2} Ci of $^{239,240}Pu$ and ^{241}Am, respectively. Other data indicate that 4.04×10^{-4} Ci of gross alpha were exhausted during 1989 (Brown et al. 1990). Applying a release fraction of 1/3,000, the potential uncontrolled release of 1.2 Ci would occur. A less significant quantity of beta-emitting radionuclides, such as ^{90}Sr, were also released. Using the CAP-88 unit dose calculations for the 200 West Area (WHC 1991b), this release would result in a 0.35-mrem/yr effective dose equivalent (EDE) from $^{239,240}Pu$ and ^{241}Am and a 1.9-mrem/yr EDE from gross alpha, which exceeds the 0.1 mrem/yr evaluation criterion. Information on the potential radioactive airborne effluent releases during routine facility operating conditions indicates the radiation EDE to the maximally exposed member of the general public would be greater than 0.1 mrem/yr, which represents 1% of the radioactive airborne effluent release limit standard of 10 mrem/yr.

The 221-T Building canyon exhaust also released 4.11×10^{-6} and 3.84×10^{-4} Ci of gross alpha and gross beta radionuclides out the 296-T-13 Roof Stack during 1989 (Brown et al. 1990). For calculation purposes, the gross alpha and beta radionuclides are considered to be ^{239}Pu and $^{90}Sr/^{90}Y$, respectively. Releases from this stack are pulled through one bank of prefilters and two banks of HEPA filters before being exhausted. If a

release fraction of 1/3,000 is assumed as the reduction attributable to the filter banks, the potential uncontrolled release would be 0.012 and 1.2 Ci of ^{239}Pu and $^{90}Sr/^{90}Y$, respectively. Using the CAP-88 unit dose calculations for the 200 West Area (WHC 1991b), this release would result in a 0.093 mrem/yr dose, which is essentially equal to the 0.1 mrem/yr evaluation criterion. Information on the potential radioactive airborne effluent releases during routine facility operating conditions indicates the radiation EDE to the maximally exposed member of the general public would be approximately 0.1 mrem/yr, which represents 1% of the radioactive airborne effluent release limit standard of 10 mrem/yr.

Information on the potential hazardous airborne effluent releases during routine facility operating conditions indicates that the quantities of hazardous materials at the point of discharge to the environment will exceed applicable reportable quantities for specific regulated substances. Specific information is presented in Attachment 1.

4.2 UPSET OPERATING CONDITIONS

4.2.1 Potential Liquid Effluents

An evaluation of the potential radioactive liquid effluent releases during upset conditions considered the failure of one engineered barrier. The entire waste system outside the canyon is either double-wall pipeline or is inside a concrete encasement. The system is sloped to drain to successive pipeline diversion boxes. Therefore, a rupture of one engineered barrier would not cause a release to the environment.

4.2.2 Potential Gaseous Effluents

Specific upset conditions for the facility that have the potential to generate radioactive airborne effluent releases are not evaluated because the magnitude of routine releases, without mitigative engineering controls, is estimated to result in a radioactive dose equivalent to the maximally exposed member of the general public of greater than 0.1 mrem/yr.

The upset condition for the facility to generate hazardous airborne effluent releases can be described as a spill of a volatile material that becomes entrained in the building exhaust. Washington State's *Dangerous Waste Regulations*, Washington Administrative Code (WAC) 173-303-145 (WAC 1989), mandate that any discharge to the environment of a dangerous waste or hazardous substance be reported. The regulations do not specify a deminimus quantity. Two volatile materials, acetone and methanol, which are classified by Washington State as moderately dangerous chemical products (WAC 173-303-9903), are stored in the 221-T Building. A spill of these materials would vaporize and become entrained in the facility exhaust. The existing airborne effluent controls (i.e., HEPA filters) would not mitigate the release.

Information on the potential releases during routine and upset facility operating conditions indicates that the radiation EDE to the maximally exposed member of the general public could exceed 0.1 mrem/yr and that quantities of hazardous materials at the point of discharge to the environment may exceed applicable reportable quantities for regulated substances. Specific information is presented in Attachment 1. Based on the data, it is recommended that a FEMP be prepared describing the effluent monitoring requirements for this facility.

5.0 SUMMARY

Based on the information collected and the data reviewed, the FEMP determination for the T Plant Facility indicates that a FEMP will be required. This determination considered radioactive and hazardous materials present during routine and upset operating conditions and the potential releases for airborne and liquid effluent pathways. It is recommended that a FEMP should be prepared based on the data for the radioactive and hazardous airborne effluent release pathways.

6.0 REFERENCES

Brown, M. J., R. K. P' Pool, and S. P. Thomas, 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas*, WHC-EP-0141-2, Westinghouse Hanford Company, Richland, Washington.

Hinckley, J. P., 1985, *T Plant Safety Analysis Report*, SD-CP-SAR-007, Rev. 0, J. P. Rockwell International, Rockwell Hanford Operations, Richland, Washington.

WAC, 1989, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Washington State Department of Ecology, Olympia, Washington.

WHC, 1991a, *A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans*, WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991b, *Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations*, WHC-EP-0498, Westinghouse Hanford Company, Richland, Washington.

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

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ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY T Plant DISCHARGE POINT Canyon Main Stack Exhaust (Stack 291-T-1-T)

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity (Ci)	Quantity released (Ci)	Projected dose (mrem)
1. $^{239,240}Pu$	Particulate	Not avail.	0.096	0.494 mrem/yr
2. ^{241}Am	Particulate	Not avail.	0.0084	0.064 mrem/yr
Total			0.1044	0.558 mrem/yr

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released	Reportable quantity (lb)	% of Reportable quantity/yr
1. Acetone	14	0	>0*	Not defined
2. Methanol	5	0	>0*	Not defined

*Washington State Department of Ecology, *Dangerous Waste Regulations* do not specify a deminimus quantity for reporting purposes (WAC 173-303-145).

Identification of Reference Material

Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Areas, Brown, M. J. et al., WHC-EP-0141-2, pg. 2-5.

T Plant Safety Analysis Report, Hinckley, J. P., Rockwell International, Rockwell Hanford Operations, Richland, Washington, SD-CP-SAR-007, Rev. 0, pg. 5-33.

Listing of Locations Which Have Chemical Stored as of 3/1/90.

Memo from Kathy Rhoads to Joe Nickels, Dose Calculations for Westinghouse Hanford FEMP, December 11, 1990.

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY T Plant DISCHARGE POINT Canyon Main Stack Exhaust (Stack 291-T-1-T)

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required _____

Evaluator Don W. Lutz Date 11-8-91

Manager, Environmental [signature] Date 11-8-91

Facility Manager [signature] Date 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY T Plant DISCHARGE POINT Roof Exhaust (Stack 291-T-13-T)

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

Radionuclide	Physical/ chemical form	Quantity (Ci)	Quantity released	Projected dose (mrem)
1.				
2.				
TOTAL				

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

Regulated material	Quantity (lb)	Quantity released	Reportable quantity (lb)	% of Reportable quantity/yr
1. Acetone	14	0	>0*	Not defined
2. Methanol	5	0	>0*	Not defined

*Washington State Department of Ecology, *Dangerous Waste Regulations* do not specify a deminimus quantity for reporting purposes (WAC 173-303-145).

Identification of Reference Material

Listing of Locations Which Have Chemical Stored as of 3/1/90.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required ______

Evaluator Don W. [signature] Date 11-8-91

Manager, Environmental [signature] Date 11-8-91

Facility Manager [signature] Date 11/8/91

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY T Plant DISCHARGE POINT Chemical Sewers

FACILITY INVENTORY AT RISK OF RADIOACTIVE MATERIALS

	Radionuclide	Physical/ chemical form	Quantity (Ci)	Quantity released	Projected dose (mrem)
1.					
2.					
3.					
4.					
TOTAL					

FACILITY INVENTORY AT RISK OF NONRADIOACTIVE HAZARDOUS MATERIALS

	Regulated material	Quantity (lb)	Quantity released	Reportable quantity (lb)	% of Reportable quantity/yr
1.	Acetone	14	0	>0*	Not defined
2.	Methanol	5	0	>0*	Not defined
3.	Acetic Acid	6	0	5,000	<1
4.	Ammonium Citrate	1	0	5,000	<1
5.	Ammonium Hydroxide	1	0	1,000	<1
6.	Mercury	3	0	1	300
7.	Methanol	5	0	5,000	<1
8.	Nitric Acid	61	0	1,000	6
9.	Phosphoric Acid	5	0	5,000	<1
10.	Potassium Permanganate	1	0	100	1
11.	Sodium	1,800	0	10	1,800
12.	Sodium Hydroxide	520	0	1,000	52
13.	Sodium Nitrite	1,900	0	100	1,900
14.	Zinc	22	0	1	2,200**

ATTACHMENT 1

DETERMINATION OF FACILITY EFFLUENT MONITORING PLAN REQUIREMENT

FACILITY T Plant DISCHARGE POINT Chemical Sewers

*Washington State Department of Ecology, *Dangerous Waste Regulations* do not specify a deminimus quantity for reporting purposes (WAC 173-303-145).

**Only fine zinc powder in reportable. Even small pieces of zinc metal do not count toward the reportable quantity. Size distribution of the zinc in the inventory was not available.

Identification of Reference Material

Listing of Locations Which Have Chemical Stored as of 3/1/90.

If the total projected dose from radionuclides exceeds 0.1 mrem EDE from any one discharge point or if any one regulated material discharged from a facility exceeds 100% of a reportable quantity or a permitted quantity, a FEMP is required for that facility. Check the appropriate space below.

FEMP is required X FEMP is not required _____

Evaluator Donald W. Fast Date 11-8-91

Manager, Environmental J. M. Nichols / for L. P. Diediker Date 11-8-91

Facility Manager R. C. Faulk Date 11/8/91

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ATTACHMENT 2

T PLANT CALCULATIONS

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T PLANT CALCULATIONS

Uncontrolled Releases - Plutonium

3.2×10^{-5} Ci (controlled release) x 3,000 release fraction = 9.6×10^{-2} Ci released with no controls

9.6×10^{-2} Ci x 5.15 mrem/Ci = 0.494 mrem/yr

Uncontrolled Releases - Americium

2.8×10^{-5} Ci (controlled release) x 3,000 release fraction = 8.4×10^{-3} Ci released with no controls

8.4×10^{-3} Ci x 7.79 mrem/Ci = 0.064 mrem/yr

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APPENDIX

UNIT DOSE CONVERSION FACOTRS PREPARED BY PACIFIC NORTHWEST LABORATORY TO BE USED IN OFFSITE DOSE CALCULATIONS

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UNIT DOSE CALCULATIONS FOR WHC FACILITY EFFLUENT MONITORING PLANS

K. Rhoads

January 3, 1991

INTRODUCTION

Dose calculations for unit (1 Ci) radionuclide releases were performed in support of efforts by Westinghouse Hanford Company (WHC) to develop Effluent Monitoring Plans for all WHC facilities on the Hanford site. Atmospheric releases from generic locations in the 100, 200 E, 200 W, and 300 areas were modeled for both elevated and ground-level releases; 400 area releases were modeled for ground level only. Impacts of liquid releases were evaluated for individuals at Ringold (100 and 200 area effluents) and Riverview (300 Area effluents). Both the CAP-88 (Beres 1990) and GENII (Napier et al 1988) code packages were used to model atmospheric releases in order to satisfy requirements of the U. S. Environmental Protection Agency (USEPA 1989) and the U. S. Department of Energy. The GENII code was used to model liquid releases.

METHODS

Standard parameters for Hanford dose calculations were included in the calculations where possible (McCormack, et al 1984). Meteorology data were collected at weather stations in each of the Hanford operating areas and represent the five-year average of data taken between 1983 and 1987. The location of the maximally exposed individual for each area is included in the attached tables with results of the dose calculations. Individual locations were based on the site boundary location having the greatest radionuclide air concentration under average atmospheric conditions. Doses were calculated as 50-year committed effective dose equivalents for all internal deposition pathways using the EPA model specified in 40 CFR 61. Default solubility classes were used for all radionuclides in these preliminary calculations. These should be appropriate for most facilities evaluated, except where plutonium or uranium are released in soluble form and contribute substantially to the overall dose from a given facility. Default classes for uranium and plutonium assume these radionuclides are released as insoluble compounds; this will result in a lower overall dose than would be the case if they were released in more soluble form.

RESULTS

Results of the evaluation are presented in Tables 1 - 11, and represent the 50-year committed dose equivalent following a chronic annual release of 1 Ci of each radionuclide. The CAP-88 and GENII codes handle ingrowth of long-lived radioactive daughter products differently, as noted in the tables. GENII calculates doses for all radionuclides in each decay chain, therefore the doses reported in Tables 1 -6 include contributions from both parent and ingrown daughters. CAP-88 does not calculate activities for ingrowth of daughter radionuclides following release of the parent, but will estimate the dose from very short-lived daughters where the parent-to-daughter activity ratio is effectively 1:1. CAP-88 doses reported in Tables 7 - 11 are for the parent nuclide only, except in the case where very short-lived daughters have been included in the parent dose as noted. CAP-88 doses including contributions from daughter ingrowth should be estimated using the fractional contribution from the parent nuclide reported in the GENII results.

The total dose expected from emissions at a given facility can be obtained by multiplying the release quantity in Ci for each radionuclide by the corresponding unit dose factor in the tables, and summing the contributions for all nuclides in the effluent stream. Please note that doses calculated using the GENII code are reported as rem to the maximum individual from an annual release; those from CAP-88 are reported in mrem. Values in the tables were taken directly from code outputs, and have been left in the units reported by each code to avoid transcription errors.

REFERENCES

Beres, D. A., 1990. The Clean Air Act Assessment Package -1988 (CAP-88). A Dose and Risk Assessment Methodology for Radionuclide Emissions to Air. Vols. 1-3, U. S. Environmental Protection Agency, Washington, D. C.

McCormack, W. D., J. V. Ramsdell, and B. A. Napier. 1984. Hanford Dose Overview Program: Standardized Methods and Data for Hanford Environmental Dose Calculations. PNL-3777, Rev. 1, Pacific Northwest Laboratory, Richland, Washington.

Napier, B. A., R. A. Peloquin, D. L. Strenge, and J. V. Ramsdell. 1988. GENII - The Hanford Environmental Radiation Dosimetry Software System. PNL-6584, Vols. 1-3. Pacific Northwest Laboratory, Richland, Washington.

U. S. Environmental Protection Agency. 1989. National Emission Standards for Hazardous Air Pollutants; Radionuclides; Final Rule and Notice of Reconsideration. 40 CFR Part 61, Federal Register 54 (240):51654-51715.

TABLE 2. GENII DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 E AREA
Location to the individual: 16000 METERS EAST

NUCLIDE	GROUND LEVEL DOSE EQUIVALENT (REM)*	89 m STACK DOSE EQUIVALENT (REM)*
H 3	2.0E-08	7.0E-09
C 14	4.2E-06	1.5E-06
MN 54	1.1E-06	3.7E-07
CO 60	9.0E-06	3.2E-06
SE 79	6.6E-05	2.2E-05
KR 85	1.6E-11	9.1E-12
SR 90	3.4E-05 (94)*	1.2E-05 (94)
Y 90	2.6E-07	9.0E-08
NB 94	1.0E-05	3.6E-06
ZR 95	1.1E-06 (75)	3.8E-07 (76)
NB 95	4.1E-07	1.5E-07
TC 99	3.4E-06	1.2E-06
RU 103	5.0E-07 (100)	1.7E-07 (100)
RU 106	1.4E-05	4.7E-06
RH 106	**	**
SN 113	7.9E-07	2.7E-07
SB 125	1.2E-06	4.2E-07
SN 126	8.4E-06 (74)	2.9E-06 (73)
I 129	8.4E-04	2.9E-04
I 131	5.1E-05 (100)	1.8E-05 (100)
CS 134	3.0E-05	1.0E-05
CS 135	3.2E-06	1.1E-06
CS 137**	2.2E-05	7.7E-06
CE 144	1.0E-05 (100)	3.6E-06 (100)
PM 147	9.8E-07	3.4E-07
RN 220	***	***
PO 216	***	***
PB 212	3.6E-06 (93)	1.3E-06 (95)
BI 212	1.7E-07	8.4E-08
PO 212	**	**
TL 208	**	**
RA 226	3.1E-04 (98)	1.0E-04 (98)
TH 230	5.5E-03 (100)	1.9E-03 (100)
U 233	2.8E-03 (100)	9.9E-04 (100)
U 234	2.8E-03	9.7E-04
U 235	2.6E-03 (100)	9.0E-04 (100)
U 236	2.7E-03	9.2E-04
U 238	2.5E-03 (100)	8.6E-04 (100)

* Doses calculated with GENII include contributions from the parent nuclide, long-lived daughter chains, and short-lived daughters. Numbers in parenthesis indicate percent of the total dose attributable to the parent nuclide in chains with long-lived daughters.

** Short-lived daughters are included in dose from parent nuclide.

*** Very short-lived; model as PB212.

TABLE 2. GENII DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 E AREA (Cont.) Location to the individual: 16000 METERS EAST

NUCLIDE	GROUND LEVEL DOSE EQUIVALENT (REM)*	89 m STACK DOSE EQUIVALENT (REM)*
NP 237	1.4E-02 (100)	5.0E-03 (100)
PU 238	6.0E-03	2.1E-03
PU 239	6.4E-03	2.2E-03
PU 240	6.4E-03	2.2E-03
PU 241	1.0E-04 (100)	3.6E-05 (100)
AM 241	9.7E-03	3.4E-03
AM 243	9.7E-03 (100)	3.4E-03 (100)
CM 244	5.5E-03 (100)	1.9E-03 (100)

* Doses calculated with GENII include contributions from the parent nuclide, long-lived daughter chains, and short-lived daughters. Numbers in parenthesis indicate percent of the total dose attributable to the parent nuclide in chains with long-lived daughters.

TABLE 3. GENII DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 W AREA
Location to the individual: 24000 METERS EAST

NUCLIDE	GROUND LEVEL DOSE EQUIVALENT (REM)*		89 m STACK DOSE EQUIVALENT (REM)*	
H 3	1.2E-08		4.7E-09	
C 14	2.4E-06		1.0E-06	
MN 54	6.0E-07		2.4E-07	
CO 60	5.2E-06		2.1E-06	
SE 79	3.8E-05		1.5E-05	
KR 85	1.0E-11		5.8E-12	
SR 90	2.0E-05	(94)*	8.0E-06	(94)
Y 90	1.5E-07		6.0E-08	
NB 94	5.8E-06		2.4E-06	
ZR 95	6.3E-07	(76)	2.6E-07	(75)
NB 95	2.4E-07		9.8E-08	
TC 99	2.0E-06		7.8E-07	
RU 103	2.9E-07	(100)	1.2E-07	(100)
RU 106	7.7E-06		3.2E-06	
RH 106	**		**	
SN 113	4.5E-07		1.8E-07	
SB 125	6.8E-07		2.8E-07	
SN 126	4.7E-06	(74)	1.9E-06	(74)
I 129	4.9E-04		2.0E-04	
I 131	2.9E-05	(100)	1.2E-05	(100)
CS 134	1.7E-05		7.1E-06	
CS 135	1.8E-06		7.3E-07	
CS 137**	1.3E-05		5.2E-06	
CE 144	5.9E-06	(100)	2.4E-06	(100)
PM 147	5.6E-07		2.3E-07	
RN 220	***		***	
PO 216	***		***	
PB 212	2.1E-06	(92)	8.6E-07	(93)
BI 212	6.1E-08		4.3E-08	
PO 212	**		**	
TL 208	**		**	
RA 226	1.7E-04	(98)	7.1E-05	(98)
TH 230	3.2E-03	(100)	1.3E-03	(100)
U 233	1.6E-03	(100)	6.6E-04	(100)
U 234	1.6E-03		6.5E-04	
U 235	1.5E-03	(100)	6.1E-04	(100)
U 236	1.5E-03		6.2E-04	
U 238	1.4E-03	(100)	5.8E-04	(100)

* Doses calculated with GENII include contributions from the parent nuclide, long-lived daughter chains, and short-lived daughters. Numbers in parenthesis indicate percent of the total dose attributable to the parent nuclide in chains with long-lived daughters.

** Short-lived daughters are included in dose from parent nuclide.

*** Very short-lived; model as PB212.

TABLE 3. GENII DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 W AREA
(Cont.) Location to the individual: 24000 METERS EAST

NUCLIDE	GROUND LEVEL DOSE EQUIVALENT (REM)*	89 m STACK DOSE EQUIVALENT (REM)*
NP 237	8.1E-03 (100)	3.3E-03 (100)
PU 238	3.4E-03	1.4E-03
PU 239	3.6E-03	1.5E-03
PU 240	3.6E-03	1.5E-03
PU 241	5.9E-05 (100)	2.4E-05 (100)
AM 241	5.6E-03	2.3E-03
AM 243	5.6E-03 (100)	2.3E-03 (100)
CM 244	3.2E-03 (100)	1.3E-03 (100)

* Doses calculated with GENII include contributions from the parent nuclide, long-lived daughter chains, and short-lived daughters. Numbers in parenthesis indicate percent of the total dose attributable to the parent nuclide in chains with long-lived daughters.

TABLE 8. CAP-88 DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 E AREA
Location to the individual: 16000 METERS EAST

NUCLIDE	10 m STACK DOSE EQUIVALENT (MREM)*	89 m STACK DOSE EQUIVALENT (MREM)*
H-3	2.19E-05	5.42E-06
C-14	2.62E-03	6.48E-04
MN-54	5.51E-03	1.51E-03
CO-60	2.90E-02	7.94E-03
SE-79	**	**
KR-85	4.88E-08	1.21E-08
SR-90	4.38E-02	1.20E-02
Y-90	3.77E-04	1.04E-04
NB-94	2.58E-02	7.05E-03
ZR-95	2.65E-03	7.24E-04
NB-95	1.76E-03	4.82E-04
TC-99	1.09E-03	2.97E-04
RU-103	1.42E-03	3.89E-04
RU-106	2.09E-02	5.71E-03
RH-106	***	***
SN-113	1.18E-03	3.23E-04
SB-125	4.15E-03	1.14E-03
SN-126	8.63E-03	2.36E-03
I-129	2.91E-01	1.84E-01
I-131	1.68E-02	1.06E-02
CS-134	3.13E-02	8.56E-03
CS-135	2.15E-03	5.87E-04
CS-137***	2.39E-02	6.54E-03
CE-144	1.37E-02	3.75E-03
PM-147	1.14E-03	3.11E-04
RN-220	****	****
PO-216	****	****
PB-212	3.32E-03	9.42E-04
BI-212	2.66E-04	1.14E-04
PO-212	***	***
TL-208	***	***
RA-226	5.45E-01	1.49E-01
TH-230	5.69E+00	1.55E+00
U-233	3.23E+00	8.83E-01
U-234	3.19E+00	8.72E-01
U-235	2.96E+00	8.10E-01
U-236	3.02E+00	8.26E-01
U-238	2.84E+00	7.77E-01

* Doses calculated with CAP88 are for the parent nuclide only, and do not include contributions from long-lived daughter chains.

** Dose factors not included in code radionuclide library.

*** Short-lived daughters are included in dose from parent nuclide.

**** Very short-lived; model as PB212.

TABLE 8. CAP-88 DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 E AREA
(Cont.) Location to the individual: 16000 METERS EAST

NUCLIDE	10 m STACK DOSE EQUIVALENT (MREM)*	89 m STACK DOSE EQUIVALENT (MREM)*
NP-237	1.19E+01	3.25E+00
PU-238	8.02E+00	2.19E+00
PU-239	8.67E+00	2.37E+00
PU-240	8.66E+00	2.37E+00
PU-241	1.38E-01	3.76E-02
AM-241	1.31E+01	3.59E+00
AM-243	1.31E+01	3.59E+00
CM-244	6.94E+00	1.90E+00

* Doses calculated with CAP88 are for the parent nuclide only, and do not include contributions from long-lived daughter chains.

TABLE 9. CAP-88 DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 W AREA
Location to the individual: 24000 METERS EAST

NUCLIDE	10 m STACK DOSE EQUIVALENT (MREM)*	89 m STACK DOSE EQUIVALENT (MREM)*
H-3	1.38E-05	3.58E-06
C-14	1.65E-03	4.28E-04
MN-54	3.27E-03	9.84E-04
CO-60	1.72E-02	5.19E-03
SE-79	**	**
KR-85	3.07E-08	7.98E-09
SR-90	2.60E-02	7.82E-03
Y-90	2.22E-04	6.73E-05
NB-94	1.53E-02	4.61E-03
ZR-95	1.57E-03	4.73E-04
NB-95	1.05E-03	3.15E-04
TC-99	6.45E-04	1.94E-04
RU-103	8.45E-04	2.54E-04
RU-106	1.24E-02	3.73E-03
RH-106	***	***
SN-113	7.02E-04	2.11E-04
SB-125	2.47E-03	7.42E-04
SN-126	5.12E-03	1.54E-03
I-129	1.14E-01	1.09E-01
I-131	6.53E-03	6.29E-03
CS-134	1.86E-02	5.60E-03
CS-135	1.28E-03	3.84E-04
CS-137***	1.42E-02	4.28E-03
CE-144	8.14E-03	2.45E-03
PM-147	6.75E-04	2.03E-04
RN-220	****	****
PO-216	****	****
PB-212	1.85E-03	5.91E-04
BI-212	9.88E-05	5.81E-05
PO-212	***	***
TL-208	***	***
RA-226	3.23E-01	9.73E-02
TH-230	3.38E+00	1.02E+00
U-233	1.92E+00	5.77E-01
U-234	1.89E+00	5.70E-01
U-235	1.76E+00	5.30E-01
U-236	1.79E+00	5.40E-01
U-238	1.69E+00	5.08E-01

* Doses calculated with CAP88 are for the parent nuclide only, and do not include contributions from long-lived daughter chains.

** Dose factors not included in code radionuclide library.

*** Short-lived daughters are included in dose from parent nuclide.

**** Very short-lived; model as PB212.

TABLE 9. CAP-88 DOSE ESTIMATES FOR 1 Ci RADIONUCLIDE RELEASES - 200 W AREA
(Cont.) Location to the individual: 24000 METERS EAST

NUCLIDE	10 m STACK DOSE EQUIVALENT (MREM)*	89 m STACK DOSE EQUIVALENT (MREM)*
NP-237	7.05E+00	2.12E+00
PU-238	4.76E+00	1.43E+00
PU-239	5.15E+00	1.55E+00
PU-240	5.14E+00	1.55E+00
PU-241	8.17E-02	2.46E-02
AM-241	7.79E+00	2.35E+00
AM-243	7.79E+00	2.34E+00
CM-244	4.12E+00	1.24E+00

* Doses calculated with CAP88 are for the parent nuclide only, and do not include contributions from long-lived daughter chains.

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